

ROYAL BOTANIC GARDENS, KEW.

---

BULLETIN

OF

MISCELLANEOUS INFORMATION.

---

No. 1]

[1914

---

I.—THE WOOD-OIL TREES OF CHINA AND JAPAN.

W. BOTTING HEMSLEY.

The *Kew Bulletin*, 1906, pp. 119–121, contains a “Revision of the Synonymy of the Species of *Aleurites*,” the main feature of which is the definition and separation of *A. Fordii*, Hemsl., from *A. cordata*, R. Br. This was followed by figures of *A. Fordii* in Hooker’s *Icones Plantarum*, xxix., tt. 2801 and 2802, Dec., 1906. Previously the very distinct *A. Fordii* had been confused with *A. cordata*, and the writer assumed that there were only these two species concerned. The incomplete herbarium and museum specimens at Kew were easily classified in this manner, both as to those from China and from Japan. But the material from the latter country was very imperfect and included no ripe fruit. Now Mr. E. H. Wilson, in a most interesting and instructive illustrated article, bearing the above title in the *Bulletin* of the Imperial Institute, vol. xi (1913), pp. 441–461, maintains that there are three species, relying mainly on the fruit for distinctive characters. “In China,” he states, “two distinct species of *Aleurites* (*A. montana*, Wils., and *A. Fordii*, Hemsl.), each occupying for the most part distinct geographical areas, yield the wood-oils of commerce. In Southern Japan a third species (*A. cordata*, R. Br.) occurs, but the oil does not figure as an article of export to Western countries. These three species from very early times have been almost hopelessly confused.” “As will be shown later,” he continues, “these three species possess very distinctive characteristics, especially in the fruit, yet in the absence of complete material it is easy to confuse them.” He then proceeds to explain the differences he finds, but does not finish with differential diagnoses and complete descriptions. Indeed, apart from the fruit and seed, he gives no definite constant differences. Concerning the Japanese tree, which he considers the true *A. cordata*, R. Br., Wilson’s knowledge is also derived from herbarium specimens and published descriptions and figures. His comparison may be abbreviated as follows:—

In general appearance the Japanese species is similar to

*A. montana*, Wils., but the flowers are rather smaller and the leaves on the flowering branches are often three-lobed. The fruit is somewhat turbinate and trigonous, about 2.5 cm. long, wider than long, flattened and often depressed at the summit, slightly tapering to the pedicel with three slight longitudinal and several irregularly transverse ridges. The fleshy part of the fruit is thin, soft, and fibrous, and encloses 3-5 seeds, which are smooth, subglobose, and 1.5 cm. in diameter. The fruit is, therefore, much smaller and more fragile than those of the two Chinese species. The foregoing fairly reproduces Wilson's enumeration and description of his differential characters. Although not accepting Wilson's description of the fruit of the Japanese tree, I agree that the available evidence favours his view that the Japanese *A. cordata* is specifically distinct from his new Chinese species *A. montana*. In this connection I have re-examined all the old material at Kew, and have also examined the additions since 1906, with the result that I can discover no essential correlative differences in the leaves, inflorescences or flowers. The leaves of the flowering branches in both Japanese and Chinese specimens are mostly entire, but sometimes three-lobed or, more rarely, five-lobed. The form and degree of development of the petiolar and laminal glands of the leaves seem to be equally variable in both, and the glands may be either prominent or almost obsolete. Of the inflorescence and flowers (as to size) the Kew material is insufficient for satisfactory comparison; but the Chinese specimens include such as bear relatively large strictly terminal inflorescences, and such as bear a number of smaller inflorescences proceeding from the axils of the upper leaves.

With regard to the size of inflorescences and individual flowers, so much depends on the age of the tree and on local conditions that little importance can be attached to size apart from other characters.

The flowers from different sources present no differences beyond degree in size, pubescence, etc., certainly nothing obvious in shape or structure. I have examined flowers, partly male, partly female, of Oldham 504, Formosa; Morse 542, Lungchow; Oldham 632, Nagasaki; and Balansa 3288, Tonquin. All, except Oldham 632, are referable to *A. montana*, Wils., though I have something more to explain concerning Balansa's specimen.

The characteristics of the flowers of all the specimens are: Calyx spathaceous, entire or more or less deeply two- or three-lobed. Petals usually 5, but varying occasionally up to 8, spathulate, longitudinally striate, more or less hairy inside in the middle portion, longer than the stamens and styles. Stamens 10, in 2 series, the inner longer, filaments more or less hairy in the middle portion. Staminodia or lobes of the disk 5; linear in the male flowers and alternating with the outer stamens; in the female flowers linear, with a broad base. Ovary more or less hairy, three-celled; styles deeply bifid.

Coming to the fruit, so far as it is known, the three proposed species are easily distinguished. *A. Fordii* has a spheroid fruit



about 5 cm. in longitudinal measurement, with an even surface and a pointed summit. *A. montana* has a somewhat larger, more ovoid fruit, with a wrinkled surface, and *A. cordata*, as represented in the Kew Herbarium by a specimen collected by K. Watanabe and by the figure in Shirasawa's *Icones*, i. t. 56, has a depressed, spheroidal fruit about 3 cm. in diameter and almost globose seeds. Shirasawa's figure, it may be added, shows both entire and lobed leaves in the inflorescence.

Now, there is no disputing the fact of these differences between the fruits of *A. montana*, Wils., and *A. cordata*, as Wilson would restrict it. He seems very confident of the validity of his new species, and there may be more in it than I have succeeded in realising; but I think it possible that selection and cultivation may account for something. Balansa's apparently luxuriant specimen from Tonquin, referred to above, is remarkable in having a small, terminal inflorescence much overtopped by the larger, deeply three- to five-lobed leaves. The flowers are small but exhibit no tangible peculiarities and no real deviations in structure from the others examined.

It may be useful to reproduce here Mr. Wilson's revised synonymy in harmony with his new classification.

***Aleurites montana*, Wilson, comb. nov.**

*Dryandra oleifera*, Lamk., *Encycl. Méth. Bot.* ii. 329 (quoad fruct.) (1786). *Vernicia montana*, Lour., *Fl. Cochinch.* 587 (1790). *Dryandra Vernicia*, Correa in *Ann. Mus. Hist. Nat. Paris*, viii. 69, t. 32, fig. 1 (1806). *Elaeococcus Vernicia*, A. Juss. ex Spreng. *Syst. Veg.* iii. 884 (1826); Steud., *Nomencl. Bot.* ed. 2, i. 545 (1840). *Aleurites Vernicia*, Hassk. in *Flora*, xxv. ii. Beibl. 40 (1842). *A. cordata*, Muell. Arg. in *DC. Prodr.* xv. ii. 724 (pro parte) (1866); Bretschneider, *Early Res. Fl. China*, 172 (1881); Hemsl. in *Journ. Linn. Soc.* xxvi. 433 (pro parte) (1894), et in *Kew Bull.* 1906, 120 (excl. specim. Japon.); Dunn, *Rep. Bot. For. Dept. Hongk.*, 1905.

SOUTH-EASTERN CHINA: Province of Fokien southward to Tongking.

It is highly probable that *A. verniciflua*, Baillon (*Hist. Pl.* v. 116, figs. 170, 171 (1874)), belongs here, but the seed only is figured, and this might well represent that of *A. Fordii*, Hemslay.

***A. Fordii*, Hemsl., in Hook. Ic. Pl. xxix., tt. 2801, 2802 (1906), et in Kew Bull. 1906, 120; Bull. Imp. Inst. v. 134 (1907); Fairchild in U.S. Dept. Agric. Circ. No. 108, cumicon. (1913).**

*Elaeococca verrucosa*, A. Juss. *Euphorb. Gen. Tent.* 38, t. 11, fig. 35 (quoad fruct. et semin.) (1824). *Dryandra oleifera*, Wall. *Cat. No.* 7958 (nomen nudum) (1828), non Lamk. *Aleurites cordata*, Hook f. *Fl. Brit. Ind.* v. 384 (1887), non R. Br.; Hemsl. in *Journ. Linn. Soc.* xxvi. 433 (excl. synon. et specim. e Hainan, e Hongkong partim) (1894); Diels in *Engl. Bot. Jahrb.* xxix. 430 (1900); A. Henry in *Chemist and Druggist*, May 31, 1902; Hosie, *Rep. Prov. Ssuch'uan*, 34 (China No. 5), 1904; Pampanini in *Nuov. Giorn. Bot. Ital. n. ser.*, xvii. 410 (1910).

CHINA: Central provinces from coast to near the borders of Eastern Thibet; also in the south-western province of Yunnan.

**A. cordata**, R. Br. Steud. ex Nomencl. Bot. 286 (1821); Muell. Arg. in DC. Prodr. xv. pt. ii. 724 (quoad specim. Japon.) (1866); Shirasawa, Icon. Ess. For. Jap. i. t. 56 (1900); Hayata in Journ. Coll. Sci. Tokyo, xx. art. 3, 55, Rev. Euphorb. Jap.) (quoad plant. Japon.) (1904); Hemsl. in Kew Bull. 1906, 120 (quoad specim. Japon.); Matsumura, Ind. Pl. Jap. ii. 300 (excl. synonym. *Vernicia montana*) (1912).

*Dryandra cordata*, Thunberg Fl. Jap. 267, t. 27 (1784); Banks, Icon. Kaempfer, t. 23 (1791). *D. oleifera*, Lamk, Encycl. Méth. Bot. ii. 329 (excl. fruct.) (1786). *Elaeococca verrucosa*, A. Juss. Euphorb. Gen. Tent. 38, t. 11, fig. 35 (excl. fruct. et semin.) (1824); Sieb. & Zucc. in Abh. Akad. Muench., iv, pt. ii, 145 (Fl. Jap. Fam. Nat., i, 37) (1843). *E. cordata*, Bl., Bijdr. 618 (1825); Miq. in Ann. Mus. Lugd.-Bat. iii 127 (Prol. Fl. Jap., 291) (1867); Franch. & Savat., Enum. Pl. Jap. i, 425 (1875). *Elaeococcus verrucosus*, A. Juss. ex Spreng., Syst. Veg., iii. 884 (1826); Steud. Nomencl. Bot. ed. 2, i. 545 (1840). *Aleurites japonica*, Bl. ex Miq. in Ann. Mus. Bot. Lugd.-Bat. iv. 120 (quasi synonym.) (1868). *Paulownia imperialis*, Chapm. in Analyst, xxxvii. 551 (1912), non Sieb. & Zucc.

SOUTHERN JAPAN: Hondo, various localities, ex Hayata, Franchet and Savatier; also cultivated.

## II.—CONTRIBUTIONS TO THE FLORA OF SIAM.

### ADDITAMENTA V.

**Polyalthia viridis**, Craib [Anonaceae-Unoneae]; *P. fragranti*, Benth. et Hook. f. et *P. Thorelii*, Finet et Gagnep., affinis, ab illa pedicellis longioribus gracilioribus, petalorum pilis simplicibus, ab hac petalis longioribus distat.

*Arbor* circiter 6-metralis (ex Kerr); ramuli juventute densius brevissime puberuli, cortice pallide brunneo vel rubro-brunneo lenticellato obtecti. *Folia* oblonga vel elliptico-oblonga, apice acute acuminata, basi truncato-cordata, 21-25 cm. longa, 8.2-9.7 cm. lata, subcoriacea, costa nervisque subtus sparsius pubescentibus exceptis glabra, nervis lateralibus utrinque circiter 18 supra conspicuis subtus cum costa prominentibus, nervulis uti reticulatione gracili pagina superiore conspicuis inferiore subconspicuis; petioli validi, fusci, vix 1 cm. longi. *Inflorescentia* ex axillis foliorum delapsorum orta, sessilis, e cymis laxè furcatis vel alternatim ramosis constituta, ad 6 cm. longa; pedicelli ad 2.5 cm. longi, breviter pubescentes, circiter 1 cm. infra apicem bracteola solitaria ad 3 mm. longa instructi. *Sepala* 3.5 mm. longa, 4 mm. lata, dorso breviter adpresse pubescentia. *Petala* viridia (ex Kerr), circiter 3 cm. longa et 4 mm. lata, glabra vel fere glabra. *Antherae* ∞, 1 mm. altae. *Carpella* 1 mm. alta, ovulis solitariis vel geminis.

Muang Hă, on edge of clearing, 600 m., Kerr 2923.



**Popowia Mesnyi**, *Craib*, comb. nov. *P. aberrans*, Pierre ex Finet et Gagnep. in Bull. Soc. Bot. Fr., Mem. 4, p. 109, vix *Polyalthia aberrans*, Maingay. *Unona Mesnyi*, Pierre Fl. For. Cochin., t. 17, pro parte.

Srirācha, Nong Yaiboo, 24 m., *Mrs. D. J. Collins* 6; Bangkok, Palace Gardens, *Murton* 30.

In Maingay's plant the carpels are nearly glabrous and the receptacle has a convex top, whereas in the plants quoted above the carpels are densely adpressed pubescent and the receptacle has a flat top.

**Melodorum oblongum**, *Craib* [Anonaceae-Xylopieae]; ab affini *M. rubiginoso*, Hook. f. et Th., sepalis fructescentibus longioribus, carpellis brevius pedicellatis recedit.

*Frutex* scandens (ex *Kerr*); ramuli primo ferrugineo-pubescentes, mox parce pubescentes, cortice fusco-brunneo reticulato-striato lenticellato obtecti. *Folia* oblonga vel cuneato-oblonga, apice rotundata, emarginata vel costa excurrente apiculata, basi ex cuneatis ad rotundata, 4·5–20 cm. longa, 2–9 cm. lata, coriacea, supra costa impressa inferne parce pubescente excepta glabra, subtus costa nervisque lateralibus praecipue ferrugineo-piloso-pubescentia, sicco brunnea, nervis lateralibus utrinque 14–15 vel foliorum minorum 10 supra impressis subtus cum costa valde prominentibus, nervis transversis subtus prominulis, supra sub oculo armato arcte reticulata, margine recurvo, petiolo ad 1·2 cm. longo supra canaliculato suffulta. *Sepala* fructescentia elongato-deltaeidea, acuta, 6 mm. longa, 3 mm. lata, dorso tenuiter adpresse pubescentia. *Petala* ignota. *Carpella* subglobosa, circiter 2·5 cm. diametro, ferrugineo-tomentella, stipite ad 1·4 cm. longo ferrugineo-tomentoso suffulta. *Semina* carpello quoque 3–4, brunnea, nitida, ad 1·8 cm. longa.

Chiangmai, Doi Sutep, in evergreen jungle, 1650 m., *Kerr* 1879.

**Thea (Camellia) confusa**, *Craib* [Ternstroemiaceae-Gordoniaceae]; a *T. Sasanqua*, Nois., foliis majoribus facile distinguenda.

*Arbuscula* circiter 7·5 m. alta; ramuli teretes, primo parce puberuli, mox glabri, cortice brunneo vel cinereo-brunneo reticulato-striato obtecti. *Folia* oblanceolata ad obovato-oblanceolata, apice acuminata, acutiuscula, basi cuneata, 6·5–13·5 cm. longa, 3–5·2 cm. lata, coriacea, costa supra pubescente excepta glabra, supra viridia, nervis lateralibus utrinque 6–8 intra marginem anastomosantibus supra subconspicuis vel leviter impressis subtus prominulis, margine recurvo inferne distanter, superne, acumine excepto, arctius denticulata, petiolo ad 7 mm. longo supra canaliculato parce pubescente suffulta. *Flores* terminales, gemini, albi, sicco 5·5 cm. diametro; alabastra 1·5 cm. alta, 8 mm. diametro; bractae imbricatae, brunneae, dorso superne praecipue adpresse albo-pubescentes. *Petala* alba, apice emarginata, ad 3·2 cm. longa et 1·8 cm. lata. *Filamenta* libera, inferne complanata, exteriora circiter 1 cm. longa, antheris 2·5 mm. longis. *Pistillum* 1·2 cm. altum, ovario 4·5 mm. alto dense albo-hirsuto, stylo

trisulcato inferne parce piloso apice trifido. *Fructus* 2 cm. altus, valvis tribus apice 3 mm. crassis dorso parce adpresse pilosis; semina brunnea—*T. japonica*, forma, Hosseus in Bot. Centralbl., Beih., vol. xxviii. p. 413. *Camellia drupifera*, Craib in Kew Bull., 1911, p. 16, non Lour. *C. sp.*, Craib, Contrib. Fl. Siam in Aberd. Univ. Studies, No. 57, p. 18.

Chiengmai, Doi Sutep, in evergreen jungle, 1200–1650 m., Kerr 889, 1363, Garrett 100, Hosseus 180.

Lao name, Mieng pa (ex Kerr).

**Thea (Calpiandra) connata**, Craib [Ternstroemiaceae-Gordonieae]; a *T. lanceolata*, Pierre, foliis tenuioribus arctius serrulatis, filamentis staminum interiorum exteriorum tubo connatis, stylo ovario aequalto recedit.

*Arbuscula* circiter 6-metralis (ex Kerr); ramuli primo densius adpresse pubescentes, mox glabri, cinereo-corticati. *Folia* plerumque oblanceolata, apice obtuse acuminata, interdum retusiuscula, basi cuneata vel cuneato-rotundata, 4–7.7 cm. longa, 1.9–3 cm. lata, chartacea vel rigide chartacea, supra costa breviter pubescente excepta glabra, subtus costa parce longiuscule pilosa, pagina utraque sed inferiore pallidius viridia, nervis lateralibus utrinque 7–9 intra marginem anastomosantibus supra prominulis subtus prominentibus, nervis transversis supra subprominulis vel tantum conspicuis subtus subprominulis; petioli ad 7 mm. longi, supra canaliculati, plus minusve glabrescentes. *Flores* solitarii, axillares, bracteis ciliolatis. *Sepala* 9 mm. longa, 7 mm. lata, ciliolata. *Petala* alba (ex Kerr), obovata, apice rotundata, 1.2–1.3 cm. longa, 8 mm. lata. *Filamenta* exteriora in tubum 1.1 cm. altum basi petalis breviter adnatum apice antheras 10–12 gerentem connata; intra tubum stamina 3, ima basi tubi connata praeterea 3–4 tubo apicem versus connata; antherae 1.5–2.5 mm. longae. *Pistillum* 4 mm. altum, ovario triloculari adpresse albo-piloso; stylus ovario aequilongus, inferne parce pilosus. *Fructus* 1.8 cm. diametro, inconspicue parcissime adpresse albo-pubescent, pericarpio circiter 0.5 mm. crasso.

Chiengmai, in evergreen jungle on Doi Sutep, 1500–1650 m., Kerr 1878, 2732.

**Indigofera oblonga**, Craib [Leguminosae-Galegeae]; ab *I. caloneura*, Kurz, foliis majoribus longius petiolatis, pedicellis fructiferis 4 mm. tantum longis recedit.

*Suffrutex* 1.5–1.8 m. altus (ex Kerr); ramuli primo densius crispatis pubescentes, plus minusve glabrescentes, angulosi. *Folia* omnia simplicia, oblonga vel elliptico-oblonga, apice parum retusa, apiculata, basi late rotundata, subcordata, ad 12.7 cm. longa et 6.3 cm. lata, rigide chartacea vel fere subcoriacea, pagina superiore glabra, inferiore costa nervisque lateralibus ferrugineo-pubescentia, ceterum albo-pubescentia, nervis lateralibus utrinque circiter 20 supra conspicuis subtus cum costa prominentibus, nervis transversis subtus prominulis, petiolo ad 1.8 cm. longo breviter crispatis albo-pubescentibus supra anguste canaliculato suffulta; stipulae subulatae, 5 mm. longae; stipellae circiter 2 mm. longae. *Racemi* fructiferi ad 14 cm. longi,



pedunculo communi petiolo brevior suffulti; pedicelli validi, 4 mm. longi. *Legumina* patula, ambitu subquadrangularia, ad 5 cm. longa, vix 4 mm. diametro, breviter brunneo-tomentella.

Between Wieng Pipao and Doi Săket, Doi Nang Keo, in mixed jungle, 840 m., *Kerr* 2524.

**Trichosanthes Kerrii**, *Craib* [Cucurbitaceae-Cucumerineae]; a *T. villosa*, Blume, cui affinis, foliis integris basi haud alte cordatis recedit.

*Ramuli* molliter plus minusve adpresse rufo-pubescentes, sulcati, ad fere 4 mm. diametro. *Folia* ovata, apice acute acuminata, basi late, haud alte, cordata, ad 14 cm. longa et 9.7 cm. lata, chartacea, supra pilis breviusculis basi tuberculatis subscabrida, subtus dense molliter villosa, nervis lateralibus utrinque 5 supra conspicuis vel subconspicuis subtus prominentibus, nervis transversis supra subobscuris subtus prominulis, petiolo ad 4 cm. longo ut ramulis molliter adpresse rufo-pubescente suffulta. *Pedicelli* ad 2.5 cm. longi. *Receptaculum* circiter 2 cm. longum, indumento ut ramuli pedicellique instructum. *Sepala* oblanceolata, acuta, 1.8 cm. longa, 4.5 mm. lata, tricostata, extra densius adpresse pubescentia, intus parcius adpresse pubescentia. *Petala* alba (ex *Kerr*), flabellata, fimbriata, circiter 1.5 cm. longa et lata, pagina utraque pubescentia.

Doi Wao, climbing on bushes in old clearing, 1050 m., *Kerr* 2454.

**Thladiantha siamensis**, *Craib* [Cucurbitaceae-Cucumerineae]; a *T. Henryi*, Hemsley, calycis lobis multo brevioribus facile distinguenda.

*Ramuli* ad 3.5 mm. diametro, striati, pubescentes; cirrhi validiusculi, superne ramosi, pubescentes. *Folia* simplicia, ovata, apice acute acuminata, basi alte cordata, sinu ad 3 cm. longo et 4 cm. lato, ad 17 cm. longa et 12.3 cm. lata, membranacea, nervis lateralibus utrinque 6 pagina utraque conspicuis, supra tenuiter pilosa, subtus costa nervis nervisque pilosula, margine integra, ciliata, petiolo 7 cm. longo validiusculo pubescente suffulta. *Pedunculus* communis inflorescentiae masculae 9.5–14 cm. longus, ut ramuli petiolique pubescens; pedicelli 3–5 cm. longi. *Receptaculum* 6 mm. altum, 6 mm. diametro, sulcatum, adpresse pubescens. *Calycis* segmenta deltoidea, 3 mm. longa et lata. *Petala* ad 1.3 cm. longa et 6.5 mm. lata. *Stamina* 5, quorum 4 filamentis per paria vix ad medium connatis, filamentis 5 mm. longis basi squamatis, praeterea squamae duae oblongae, receptaculi fauce insertae, 3 mm. longae, 2 mm. latae. *Ovarii* rudimentum deficiens.

Chiengmai, Doi Sutep, evergreen jungle, 660 m., *Kerr* 1171.

**Vernonia Kerrii**, *Craib* [Compositae-Vernonieae]; a *V. Helfer*, Hook. f., cui affinis, involucri bracteis brevioribus angustioribus distinguenda.

*Caules* 13–23 cm. alti, primo subadpresse hirsuti, saepe flexuosi, mox glabri, circiter 1.5 mm. diametro. *Folia* oblanceolata, oblongo-oblanceolata vel late oblanceolata, apice acuta, obtusa vel rarissime fere rotundata, basi cuneata vel late cuneata,

4-6 cm. longa, 1.1-2.3 cm. lata, rigide chartacea, supra costa tantum basin versus praecipue pilis paucis brevibus instructa, subtus pilis paucis brevibus costa nervisque instructa, margine apicem versus praecipue distanter pauciserrata, nervis lateralibus utrinque 8-10 cum nervis transversis pagina superiore fere subprominulis inferiore prominentibus; petiolus 0-3 mm. longus, pubescens. *Capitula* terminalia axillariaque, solitaria, fasciculata vel breviter racemosa, subsessilia vel breviter pedunculata. *Involucri* bracteae superne primo brunneo-pilosae, mox glabrae, mucronatae, exteriores breves, deltoideae, interiores lineari-oblongae, 7.5 mm. longae, 1.25 mm. latae. *Pappus* basi breviter connatus, biseriatus; ordo exterior 0.75 mm. longus, interior 6 mm. longus. *Corollae* tubus 6.5 mm. longus, lobis 2.25 mm. longis. *Antherae* basi sagittatae, vix 2.5 mm. longae. *Stylus* superne breviter pubescens. *Achaenia* vix matura, 3 mm. longa, sulcata, pubescentia.

Mê Nan, Sop Ngao, rock crevices by river, 210 m., *Kerr* 2404.

**Exacum sutapense**, *Hosseus* in Engler Bot. Jahrb., vol. xl. Beibl. 93, p. 99. (nomen); id. in Bot. Centralbl. Beih., vol. xxviii. p. 426 (nomen); *Craib* in Kew Bull., 1911, p. 421 et Contrib. Fl. Siam in Aberd. Univ. Studies, No. 57, p. 137 (nomen); ex *Craib* [Gentianaceae-Exaceae]; ab *E. pterantho*, Wall. ex Griseb., partibus omnibus minoribus, foliis breviter petiolatis distinguendum.

*Herba* 2.5-16 cm. alta, glabra, caule saepissime simplice angulato. *Folia* ex lanceolatis ad rotundata, apice brevissime subacute acuminata vel obtusa, basi cuneata vel late cuneata, ad 12 mm. longa et 8 mm. lata, trinervia, nervis subconspicuis, petiolis brevibus suffulta. *Sepala* acuminata, acuta, 3.5-4 mm. longa, 1.25 mm. lata, dorso medio ala 1 mm. alta ornata, glabra. *Corolla* viva caerulea, sicco lutea; tubus 4 mm. longus; lobi oblongi, acutiusculi, 6 mm. longi, 2.25 mm. lati. *Filamenta* 1.25 mm. longa, antheris vix 1.5 mm. longis. *Ovarium* 2 mm. altum, glabrum; stylus 3 mm. longus, glaber.

Chiengmai, Doi Sutep, in open grassy ground, 1650 m., *Hosseus* 194, *Kerr* 1499.

**Trichodesma calcareum**, *Craib* [Boraginaceae-Boragaeae]; a *T. khasiano*, C. B. Clarke, cui affine, alabastris brevioribus latioribus, calyce sub anthesin breviori eiusque lobis fructescentibus latioribus distinguendum.

*Caules* 1.2-1.5 m. alti (ex *Kerr*), subhispide albo-pubescentes. *Folia* opposita, elliptica vel subrhombico-elliptica, apice acute acuminata, basi attenuata, ad 28 cm. longa et 11.3 cm. lata, chartacea, supra scabrida, subtus molliuscule albo-pubescentia, nervis lateralibus utrinque 8-9 supra conspicuis subtus prominulis, nervis transversis subtus subprominulis, margine plerumque parum recurvo, petiolo ad 7 mm. longo suffulta. *Panicula* terminalis, pyramidata, circiter 24 cm. longa et 15 cm. diametro; bracteae lineares vel lineari-lanceolatae, ad 1 cm. longae; pedicelli graciles, ad 1.7 cm. longi; alabastra acuminata, ad 1.3 cm. longa. *Calycis* extra hispiduli sub anthesin tubus 6 mm. longus, lobi 4, basi 5 mm. lati, 8 mm. longi, circiter e medio



arcte reflexi; calycis fructiferi ad 2.7 cm. longi lobi recti. *Corollae* albae (ex *Kerr*) tubus circiter 8.5 mm. longus, intra infra antheras densius villosus; limbus arcte reflexus, circiter 2.3 cm. diametro; lobi caudato-acuminati, 1 cm. longi. *Antherae* dorso dense albo-villosae, longe acuminatae, 1 cm. (acumine incluso) longae, exsertae. *Ovarium* glabrum, 1.5 mm. altum; stylus 1.5 cm. longus, glaber.

Doi Chieng Dao, crevices of limestone rock, 900 m., *Kerr* 2856.

***Argyreia Henryi*, Craib**, comb. nov. *Ipomoea Henryi*, Craib in *Kew Bull.*, 1911, p. 423 et *Contrib. Fl. Siam in Aberd. Univ. Studies*, No. 57, p. 140.

Chiengmai, Doi Suteb, 660–900 m., *Kerr* 1489, 2773.

*Distr.* Yunnan.

*Kerr* 2773, in fruit, shows that this is not an *Ipomoea* but an *Argyreia* near to *A. oblecta*, C. B. Clarke, from which it may be distinguished by the leaves being ultimately glabrous above and with few adpressed stiff hairs on the lower surface.

***Peristrophe parviflora*, Craib** [Acanthaceae-Justicieae]; *P. montanae*, Nees, *P. tinctoriae*, Nees et *P. ferae*, C. B. Clarke habitu similis sed floribus parvis facile distinguenda.

*Fruticulus* gregarius, 1.2–1.5 m. altus (ex *Kerr*); caules primo pilis brevibus reflexis parce instructi, mox glabri vel fere glabri, sulcati. *Folia* lanceolata vel ovato-lanceolata, apice acuminata, acutiuscula, basi cuneata, ad 7.6 cm. longa et 2.8 cm. lata, chartacea, supra costa parce pubescente excepta glabra, subtus pilis rigidis brevibus parcius instructa, nervis lateralibus utrinque 4–6 supra obscuris vel subobscuris subtus prominulis, nervis transversis paucis tantum subtus conspicuis, petiolo ad 1.5 cm. longo suffulta. *Bracteae* duae, inaequales, 1.5–2 cm. longae, 5.5–7 mm. latae, virides, parce pubescentes, ciliatae; bracteolae deltoideae ad lanceolatas, acuminatae, acutae, 2 mm. longae, 0.75–1.25 mm. latae, ciliatae, hyalinae. *Calyx* 3 mm. longus, lobis lanceolatis acutis 0.5 mm. latis tubo subaequilongis. *Corolla* lilacina (ex *Kerr*), 1.45 cm. longa, extra breviter pubescens, tubo 9.5 mm. longo. *Stamina* 2, filamentis pilis paucis albis divaricatis rigidiusculis instructis. *Ovarium* ambitu oblongum, 1.5 mm. altum, glabrum; stylus 1.25 cm. longus, glaber.

Doi Wao, by stream, 660 m., *Kerr* 2445.

***Rungia maculata*, Craib** [Acanthaceae-Justicieae]; a *R. Brandisii*, C. B. Clarke, bracteis haud marginatis distinguenda.

*Caules* herbacei, ad 1.5 mm. diametro, pilis deflexis breviusculis tecti. *Folia* oblanceolata, oblongo-oblanceolata vel oblongo-lanceolata, apice obtusa vel subacuta, basi cuneata, 2–7 cm. longa, 0.8–3 cm. lata, chartacea, supra variegata (ex *Kerr*), pagina utraque breviter parcius pubescentia, nervis lateralibus utrinque 5–6 cum costa supra conspicuis subtus prominulis, ciliolata, petiolo ad 7 mm. longo suffulta. *Spicae* et terminales et ramulos breves laterales terminates, 2–4.5 cm. longae, breviter pedunculatae; bracteae late oblanceolatae vel oblongo-oblanceolatae, acuminatae, acutae, 8 mm. longae, 2.5 mm. latae,

utrinque puberulae, pilis longiusculis ciliatae; bracteolae inaequales, 3-5.5 mm. longae, 0.5-1 mm. latae, ciliolatae. *Sepala* 4.5 mm. longa, 0.5 mm. lata, pubescentia. *Capsula* 6 mm. longa, pubescens; semina compressa, 1.75 mm. diametro, pallide brunnea, papillosa.

Prê, Hue Kamin, near stream, 240 m., *Kerr* 2348.

***Rungia rivicola*, Craib** [Acanthaceae-Justicieae]; ab affini *R. apiculata*, Bedd., antheris basi albo-appendiculatis recedit.

*Caules* primo flexuosi, bifacialiter breviter pubescentes, ceterum fere glabri, mox glabri. *Folia* lanceolata vel ovato-lanceolata, utrinque acuminata, apice obtusa, 4.5-10 cm. longa, 1.5-3.7 cm. lata, chartacea, supra glabra, subtus mox fere glabra, nervis lateralibus utrinque 6-8 supra conspicuis vel subobscuris subtus prominulis, nervulis paucis subtus conspicuis; petioli foliorum oppositorum inaequales, 5-14 mm. longi, lateribus breviter crispatis pubescentes. *Spicae* et axillares et terminales, ad 3 cm. longae, breviter pedunculatae; bractae parum inaequilaterales, obovatae vel obovato-ellipticae, acute acuminatae, 0.9-1 cm. longae, 4 mm. latae, costa prominula, nervis subconspicuis, utrinque puberulae, ciliolatae, margine hyalino vel saepius purpureo-suffuso; bracteolae forma bracteis similes, 6.5-9 mm. longae, 2-2.25 mm. latae, puberulae, ciliolatae, hyalinae. *Sepala* 5, lanceolata, superne attenuata, 7 mm. longa, 1 mm. lata, puberula, ciliata, hyalina. *Corolla* pallide viridis, labio purpureo-maculata (ex *Kerr*); tubus 7.5 mm. longus, labio infero 4.5 mm. longo quam supero paulo brevior. *Stamina* 2, labio inferiori subaequilonga. *Ovarium* 1.5 mm. altum, glabrum, stylo parce breviter adpresse pubescente.

Doi Wao, by stream, 720 m., *Kerr* 2443.

***Aristolochia (Siphisia) grandis*, Craib** [Aristolochiaceae]; ab affini *A. Balansae*, Franchet, foliis majoribus subtus costa nervisque lateralibus adpresse pubescentibus, pedicellis longioribus recedit.

*Caules* alte volubili; ramuli setulis plus minusve adpressis parcius instructi, mox fere glabri, pallide brunneo-corticati. *Folia* elliptica vel late oblonga, apice obtusa, rarissime retusa, basi rotundata vel truncato-rotundata, 11-25 cm. longa, 7-15 cm. lata, coriaceo-chartacea, supra sicco viridia, glabra, subtus pallida, costa nervisque lateralibus adpresse pubescentia, nervulis pilosula, nervis lateralibus utrinque 7-8 intra marginem anastomosantibus cum costa supra conspicuis subtus valde prominentibus, nervis transversis supra conspicuis subtus prominentibus, petiolo 3.5-8.5 cm. longo primo tomentello mox puberulo suffulta. *Cymae* racemiformes, axillares, foliis multo breviores, pauciflorae, parce brunneo-pilosae; bractae parvae, brunneo-tomentosae; pedicelli sub anthesin 7.5 cm. longi. *Receptaculum* ad 2 cm. longum, 2 mm. diametro, dense breviter pallide brunneo-pilosum. *Calyx* paulo infra medium refractus, circiter 4.5 cm. longus, extra breviter parce pubescens, extra albus, brunneo-venosus, intra luteus (ex *Kerr*); limbus paulo ampliatus, papillosus, brunneus (ex *Kerr*). *Fructus* 13 cm. longus, 3 cm. diametro, parce breviter pubescens.



Chiengmai, Doi Sutep, in evergreen jungle by a stream, 750-900 m., *Kerr* 2223, 2223A.

**Sauropus bicolor**, *Craib*, nom. nov. *S. rigidus*, *Craib* in *Kew Bull.*, 1911, p. 457 et *Contrib. Fl. Siam in Aberd. Univ. Studies*, No. 57, p. 183, *non Thwaites*.

Chiengmai, Doi Sutep, in deciduous jungle, 300-1560 m., *Kerr* 651, 1825.

*Distr.* Tenasserim, *Gallatly*.

### III.—COLD STORAGE OF FRUIT AND VEGETABLES.

L. A. BOODLE.

The storage of fruit is a matter of some commercial importance, and a thorough knowledge of the best conditions for keeping ripe or unripe fruit of different kinds will be of great value in relation to the conveyance of fruit to a distance, and for other purposes. The methods at present in use, including refrigeration, have made it possible to carry many kinds of fruit for long sea voyages. The partial spoiling of a cargo of fruit is, however, a not uncommon occurrence, and attention is therefore called to the possibility of effecting improvements in method. The finding of such improvements will be greatly helped by a good knowledge of the physiological processes going on in fruits at different stages of ripening and at different temperatures, and it appears that much still remains to be learnt on this subject.

A paper recently published\* records a number of experiments on the respiration of fruits, made with the object of gaining fresh data, which might be useful in connection with fruit-storage. The paper also contains a summary of literature dealing with different matters relating to the process of respiration.

In the experiments described in this paper, the respiration of different fruits when kept in air, in nitrogen, and in hydrogen was measured, and the keeping power of fruits in these gases and in carbonic acid gas was also tested.

An experiment with ripe cherries† was carried on for about 60 hours at 30° C., and gave the following result. The average hourly production of carbonic acid reckoned in milligrammes (mg.) per hundred grammes (grm.) of cherries was 14.2 in air, 12.0 in nitrogen, and 11.3 in hydrogen. In this case the fruit was kept in a continuous current of the respective gases. Another experiment was differently arranged, the gases being left undisturbed, except for half-an-hour twice a day, when they were drawn through the vessels containing the fruit as in the first experiment. Here the amounts of carbonic acid given off are represented by the figures 12.2 in air, 9.9 in nitrogen, and 10.9

\* George R. Hill, Jr. Respiration of fruits and growing plant tissues in certain gases, with reference to ventilation and fruit storage. *Bulletin* 330, Cornell Univ., Agric. Exp. Stn. of the Coll. of Agric., Dept. of Plant Physiology, 1913, Ithaca, N.Y., published by the University.

† The fruit was sterilised by dipping in 95 per cent. alcohol, and was then dipped in sterilised water.

in hydrogen. It is seen that in these two experiments the production of carbonic acid in an atmosphere of nitrogen or hydrogen, *i.e.*, in the absence of oxygen, is not far behind that in air, or in other words anaerobic respiration is not much less than aerobic.

Experiments were made with two varieties of ripe grapes,\* and gave the result that respiration was as active in nitrogen and hydrogen as in air, more so in fact in some cases. One of the experiments carried on for 114 hours at 30° C. gave 5.2 mg. of carbonic acid per hundred grammes of fruit per hour in air, 6.2 in nitrogen, and 7.3 in hydrogen. The other experiment (34 hours at 37° C.) gave 9.9 in air, 9.5 in nitrogen, and 10.2 in hydrogen.

The above experiments show that in ripe fruits at 30° C. anaerobic respiration may be as rapid as aerobic, or not much less so.

An experiment was also made with unripe fruit, and this showed a different behaviour. Green peaches, about half grown, gave off 13.4 mg. of carbonic acid per 100 gm. of fruit per hour in air, 6.4 in nitrogen, and 6.1 in hydrogen.† Here the anaerobic is only about half the aerobic respiration. The difference between this ratio and those in the previous experiments may be attributed to the presence of growing tissues in the unripe fruit.

Germinating wheat was chosen as another example of actively growing tissue, and gave a similar result to the green peaches in one case‡ namely, 12.8 mg. in air, 6.0 in nitrogen, and 6.5 in hydrogen. In a second experiment§ there was a much greater difference between the amount of carbonic acid produced in the presence and absence of oxygen, the values being 33.5 mg. in air, 7.8 in nitrogen, and 6.4 in hydrogen.||

It appears then from the different experiments that ripe fruit differs from unripe fruit in its respiratory processes, respiration in the former being to a great extent independent of an external supply of oxygen, while in the latter about half the respiration is stopped in the absence of oxygen. This is regarded as indicating that respiration in ripe fruit is probably maintained for the most part by enzymes which work independently of oxygen, while in unripe fruit the respiration is partly of the same nature, but is as much due to processes dependent on the presence of

\* Sterilised in alcohol.

† The experiment was run for 90 hours at 30° C.; the peaches were not sterilised.

‡ The experiment lasted 81 hours at 25° C. Previous experiments have shown that in germinating wheat intramolecular (anaerobic) respiration is much less than normal respiration, and this appears to be generally the case in aerobic plants. There are exceptions, however, seedlings of the broad bean and the castor-oil plant having been found to respire equally with and without oxygen.

§ 83 hours at 25° C.

|| In the first of these two experiments the seeds had been sterilised in alcohol, and in formalin in the second. Hence it appears that one of the sterilising agents must have penetrated a little too far and affected the living tissue. Either the alcohol-treatment retarded respiration, or the formalin increased it.



oxygen. The latter processes may be enzymatic, but it is probable that the direct metabolism of the protoplasm plays a considerable part in them.

A calculation has been made in order to give an idea of the volume of carbonic acid given off in these experiments. The amount produced per hour by 100 grammes of ripe grapes at 30° C. was 5.2 mg. This would measure about 2.9 cubic centimetres, and the grapes at this rate would give off a volume of carbonic acid equal to their own bulk in about 32.6 hours, while the cherries in the first experiment would produce a corresponding amount in 11.8 hours.\*

Other experiments were made on the keeping quality of fruits in air and in other gases. In one case apples of one variety were placed in jars of air, nitrogen and hydrogen, and left for 13 days. In each jar some apples were fairly ripe, and others somewhat green. At the end of the experiment the apples in air were in very good condition,† while those in nitrogen and hydrogen had lost their red colour, and had turned brown, both their appearance and flavour being much as in half-baked apples. This effect in nitrogen and hydrogen was shown not to be due to micro-organisms, but to the anaerobic respiration of the fruit. This shows the necessity of aeration when apples are kept for a considerable time at the temperature of the experiment, which was 21° to 23° C.

Another experiment was made with peaches, and it was found that they became brownish and acquired a bad flavour in the absence of oxygen, and that the softening of hard, unripe specimens was greatly decreased in carbonic acid, and to a considerable extent in nitrogen and hydrogen, as compared with air.

In two experiments referred to above it was found that ripe cherries respired much more rapidly than ripe grapes in the ratio of 14.2 to 5.2‡. In view of the better keeping properties of grapes as compared with cherries, it is suggested that the rate of evolution of carbonic acid may be more or less proportional to the rate of spoiling of ripe fruit, and this may also be proportional to the enzyme content of the fruit, since the processes concerned are probably chiefly due to the action of enzymes.§ Hence, if the factors controlling the production of enzymes were sufficiently understood, additional means might perhaps be found for improving the keeping quality of fruit.

It is desirable that further experiments should be made, in the same manner as those referred to above, on the production of carbonic acid by various kinds of fruit at different temperatures much lower than 30° C. Definite and comprehensive information on respiration at rather low temperatures would no doubt be very useful in relation to cold storage.

Feeble respiration takes place at 0° C., and even at -2° to -4° C., and it continually increases as the temperature rises, until

\* These figures are obtained by reckoning the fruit as having a specific gravity of 1.097, this being the value obtained with a sample of grapes.

† Except two out of seven, which appeared to have developed brown rot.

‡ This was in both cases in a continuous current of air at 30° C.

§ As suggested by the fact that they are largely independent of oxygen.

injury from high temperature begins.\* Within a few degrees above freezing point respiration is no doubt very slight, and it is owing to this fact that fruit can be kept for a considerable time in refrigerating chambers. Suitable temperatures for different purposes have been found by experience, but more precise knowledge of the behaviour of fruit at these temperatures is required.

A matter requiring special attention in the storage of fruit is aeration. Air should have as free access to the fruit as possible, and therefore large masses of fruit should not be closely crowded together. Good circulation of the air should also be kept up, and for this the current of cold air from the refrigerating machine may often be sufficient, but in some cases ventilating fans have been used. The amount of care necessary in the matter of aeration depends, of course, largely on the temperature chosen for the storage chamber, as well as on the kind and condition of the fruit.

In the case of the transport of peaches in America in refrigerator cars, injury to the fruit is stated to be common, and the injury has been found to be most frequent in the central part of the top tiers of boxes. Cold air† is led along the bottom of the car, and, though diffusion and circulation equalise the temperature to some extent, it may be assumed that the upper strata of air have a somewhat higher temperature than the lower, and therefore that the fruit in the upper boxes respire more actively than the rest. The explanation is therefore suggested‡ that the injury is "due to insufficient oxygen and to an accumulation of carbon dioxide within the paper wrappers in which peaches are so often shipped." The preventive would no doubt be more uniform cooling, with better aeration if necessary.

It must be remembered that active respiration means an appreciable evolution of heat by the respiring tissues. Hence, in the case of large masses of fruit, if this heat is not rapidly conducted away, the temperature of the fruit (and of the air adjoining it) will rise, whereby the respiration will be further increased, and so on. Such heating at "compound interest" will be liable to occur locally, wherever aeration is insufficient, and may continue until the local temperature is considerably higher than the general air temperature in the refrigerating chamber, and may lead to the loss of portions of the fruit.

Should the temperature in the cold storage chamber be allowed to rise until respiration is very active, it may be found that the refrigerating apparatus will be unable to reduce the temperature of the fruit again, and this has been experienced, *e.g.*, in shipments of bananas.§ The fruit then ripens rapidly and spoils.

\* Pfeffer, *Physiology of Plants* (Eng. ed.), vol. I., p. 561.

† From ice-bunkers.

‡ G. R. Hill, *loc. cit.* The injury had been described by a dealer as "ice-scald," but the peaches had probably not been in a temperature lower than 7° C. (45° F.). Whole car-loads of the fruit are occasionally spoilt.

§ When the refrigerating machine has been out of order for a time. Bananas are not kept at a very low temperature during ocean transport. About 7° C. (45° F.) is the temperature chosen in some cases.



The difficulties to be contended with in arranging for the cold storage of vegetables may be illustrated by the following case.

An insulated storage room of about 6000 cubic feet capacity was fitted with a refrigerating machine, which easily reduced the air in the room, when empty, to a temperature of 27° F. (—3° C.). A temperature of 35° F. (2° C.) was required, and it was expected that the arrangements would be satisfactory. A trial was then made as to storage. Six tons of vegetables\* were put into the room, and the temperature started at 59° F. (15° C.), but the machine was only able to reduce this to 50° F. (10° C.) in 10 hours. The refrigerator was then stopped, and in 12 hours the temperature was 59° F., and after 15 hours more it stood at 66° F. (19° C.). The air, moreover, was found to be badly vitiated by carbonic acid. The final rise of temperature was due to the respiration of the vegetables† and not to conduction through the walls, since the outside temperature during the last 24 hours had not been higher than 52° F. (11° C.), having varied between this and 45° F. (7° C.).

In another trial the machine was started first, and the temperature was reduced to 38° F. Then two and a half tons of cabbage and spinach were put into the store. The temperature was raised by this to 48° F., and after an hour with the machine still running it rose to 49° F. After five hours' run it stood at 45° F., and refused to go lower.

In this case the free air in the storage-chamber was well circulated. The unsuccessful result indicates that the vegetables required to be less crowded, or to be cooled in small batches before being brought into the store. The air must have been a good deal entangled among the vegetables, so that convection currents in the interior of the mass in each box would be slow, and consequently the loss of heat‡ in this way was not rapid enough to out-balance the heating due to respiration. Had the vegetables been cooled before being placed in the store-room, their respiration and self-heating would have been slow, and the refrigerating arrangements might perhaps have been able to deal with them efficiently, though unable to cope with the combined task of cooling the substance of the vegetables, and also removing the heat generated by respiration at or near the starting temperature.§ The entanglement of air and consequent difficulty of cooling would probably be much greater in a box of spinach, for instance, than in a box of the same dimensions containing fair-sized rounded fruit such as apples or oranges.

It can be readily understood that the matter of cold storage of fruit and vegetables is not a simple one. The treatment required by different kinds of fruit or vegetables may vary considerably as

---

\* In boxes.

† The result in this trial was probably almost entirely due to ordinary respiration, though a small proportion may represent increased respiration of cut and bruised surfaces. A little bacterial action may possibly have begun, and contributed slightly to the rise in temperature.

‡ To the refrigerated air.

§ This refers to vegetables badly placed for cooling, not to those well exposed to the refrigerated air.

to spacing out, packing, aeration and temperature. Much information has been gained by practical experience, but further knowledge is required, so that any failure causing loss of produce may be attributed to its precise cause, and, if possible, prevented for the future.

In conclusion reference should be made to another important point in connection with the cold storage of vegetables and fruit, namely, the cost of the refrigerating plant and the running expenses. For although it may be quite possible to keep a chamber at a desired temperature when filled with vegetables or fruit, yet the outlay involved in connection with the packing and unpacking and the laying out of the material on shelves, in addition to the cost of running the special refrigerating plant, may be so great as to render the undertaking impossible from the commercial point of view.

#### IV.—DIAGNOSES AFRICANAE : LVI.

1471. *Diplotaxis inopinata*, Sprague [Cruciferae-Brassicaceae]; affinis *D. eruroidi*, DC et *D. griquensi*, Sprague; ab illa floribus minoribus, siliqua juventute pilosa, ab hac inflorescentia longiore rhachi cauleque minus hispidis pilis omnibus retrorsis, siliquis tandem glabris differt.

*Herba* erecta, annua, circiter 30 cm. alta, radice  $\pm$  verticali pauciramoso. *Caulis* retrorse hispidulus, superne pauciramosos ramis brevibus ascendentibus. *Folia radicalia* lyrata lobo terminali elliptico lateralibus utrinque 3-4 triangulari-ovatis vel oblongis, utrinque praecipue subtus densiuscule subadpresso pilosa, 4-5 cm. longa, 1.5-2 cm. lata; petioli usque ad 2 cm. longi. *Folia caulina* lobis lateralibus unijugatis vel bijugatis lobo terminali pro rata magnæ oblongo-elliptico, superiora lobo terminali subtriangulari acuto. *Racemi* sub fructu usque ad 25 cm. longi. *Flores* 2-3 in anthesi in eodem tempore, in toto vix 5 mm. longi; pedicelli 2-2.5 mm. longi, glabri (vel apice tantum pilis paucis retrorsis). *Sepala* erecta, aequilonga, 3.5 mm. longa, extra longiuscule crispule pilosa, apice hyalina, anterie et posterius oblongo-linearia, 0.7-0.8 mm. lata, lateralibus lanceolata-oblonga, 1 mm. lata. *Petala* erecta, limbo ascendente, spathulata, 4.5 mm. longa, 1.2 mm. lata, limbo obovato 2.5 mm. longo in unguem angustato pinnatim venoso venis utrinque 3-4. *Filamenta* lateralibus 2.5 mm., anteriora et posteriora 3 mm. longa; antherae 0.8-0.9 mm. longae, sagittatae. *Glandulae* laterales bilobae, 0.3 mm. latae, anterior et posterior minimae. *Ovarium* tetragonum, 2.7 mm. longum, 0.5 mm. crassum; stylus crassus, vix 0.5 mm. longus; stigma integrum, apice cavo minuto centrali. *Siliquae* 2-3.5 cm. longae, glabrae, stylo haud 1 mm. longo stigmatibus subintegrato coronato; septum 1.5 mm. latum; valvae valde uncostatae, post dehiscenciam explanatae, 2.5-3 mm. latae. *Semina* plane regulariter biseriata, oblongo-ellipsoidea; cotyledones obdeltoidei, lateribus convexis, truncati, vix 1 mm. longi, ultra 1 mm. lati; radícula ultra 1 mm. longa.



TROPICAL AFRICA. British East Africa: Nairobi, 1800 m., very common on cultivated land, *W. J. Dowson* 3.

The only species of *Diplotaxis* hitherto recorded from Tropical Africa is *D. erucoides*, DC., a native of the Mediterranean region and the Orient, which occurs in Abyssinia, according to A. Richard (Tent. Fl. Abyss., vol. i, p. 24). *D. inopinata* bears a superficial resemblance to certain forms of *D. erucoides*, but exhibits greater affinity with *D. griquensis*, Sprague (n. comb.), a native of South Africa (*Brassica griquensis*, N. E. Brown in Kew Bull., 1894, p. 353). Both *D. inopinata* and *D. griquensis* have siliques with a short cylindric beak, oblong-ellipsoid seeds arranged in two distinct and regular rows, and truncate cotyledons—a combination of characters that, according to Prantl (Nat. Pflanz., vol. iii. 2, pp. 175–176), is characteristic of the genus *Diplotaxis*.

1472. **Guizotia reptans**, *Hutchinson* [Compositae-Helianthoideae]; species caulibus procumbentibus e nodis radicanibus valde distincta.

*Herba* procumbens, caulibus e basi foliosis usque ad 7 cm. longis e nodis radicanibus crassis glabris vel fere glabris, radicibus subsimplicibus ad 6·5 cm. longis. *Folia* opposita, spathulato-oblongata, apice rotundata, basi in petiolum latum striatum attenuata, caulis apicem versus paulatim longiora, 1–3 cm. longa, 0·5–1·3 cm. lata, remote denticulata, ciliata, tenuiter chartacea, supra parce setuloso-pilosa, infra glabra; costa inferne latissima et longitudinaliter striata, superne multo angustiora; nervi laterales utrinque 4–5, arcuati, distincti sed haud prominentes. *Capitula* in caule quoque apicem versus axillaria solitaria, pedunculata, circiter 2·5 cm. expansa; pedunculus 0·5–1 cm. longus, robustus, parce setuloso-pilosus. *Involucri bractee* liberae, paucae, tenuiter foliaceae, ovata-ellipticae ad oblongae, obtusae, usque ad 1 cm. longae et 3 mm. latae, longitudinaliter striatae, longe et patule ciliatae, utrinque glabrae. *Flores* radii 6–7, lutei; pappus in utroque sexu nullus; corollae tubus cylindricus, 2·5 mm. longus, glaber; limbus oblongo-oblongeolatus, ad 1·5 cm. longus et 0·8 mm. latus, apice trilobatus, multistriatus, glaber; stylus exsertus. *Flores disci* pauci; corollae tubus inferne cylindricus, 3 mm. longus, basin versus extra minute setulosus, superne subcampynulatus; lobi 5, lanceolati, subobtusiusculi, 1·5 mm. longi; antherae 2·5 mm. longae. *Achaenia* oblonga, basi leviter constricta, 3 mm. longa, glabra.

TROPICAL AFRICA. British East Africa: Aberdare Mountains, 3000 m., *Battiscombe* 530.

1473. **Linociera Battiscombei**, *Hutchinson* [Oleaceae-Oleinae]; species foliis plerumque lanceolatis, floribus in axillis dense glomeratis valde distincta.

*Arbor* usque ad 12 m. alta; ramuli cortice pallide cinereo obtecti, prominenter lenticellati, juniores parce pubescentes. *Folia* lanceolata vel elliptico-lanceolata, utrinque obtusa, 4–9 cm. longa, 1·5–3·3 cm. lata, integra, coriacea, supra nitida, infra pallida, utrinque glabra, nervis lateralibus gracilibus utrinque

4-5 arcuatis a costa angulo  $45^{\circ}$  abeuntibus utrinque distinctis sed vix prominentibus; petioli 3-5 mm. longi, robusti, minime transverse rugosi, leviter puberuli. *Flores* axillares, glomerati, glomerulis circiter 10-floris; bracteae oblongo-ovatae, subacute acuminatae, 4 mm. longae, 2 mm. latae, coriaceae, extra pubescentes. *Calycis* segmenta 4, duo ovata, obtusa, 1.75 mm. lata, duo alterna lanceolata, subacuta, omnia coriacea, intra glabra, extra pubescentia. *Corollae* tubus 2 mm. longus, glaber; segmenta oblongo-lineararia, apice obtusa et cucullata, circiter 7 mm. longa et 2.5 mm. lata, glabra, marginibus involutis. *Antherae* subsessiles, 1.75 mm. longae. *Ovarium* ovoideum 1.5 mm. longum, glabrum; stylus brevis, stigmatibus basi sagittato.

TROPICAL AFRICA. British East Africa: Nairobi forests, 1700 m., *Battiscombe* 517.

This is a very distinct species more or less distantly related to *L. congesta*, Baker, from the Cameroons and Gaboon, with which it agrees in its axillary glomerate flowers, but differs markedly in the shape of the leaves and larger flowers.

1474. *Xysmalobium Pearsonii*, N. E. Brown [Asclepiadaceae-Cynancheae]; affinis *X. winterbergensi*, N. E. Br., sed foliis longioribus minus crispatis, umbellis 4-5-floris et coronae lobis planis ecarinatis differt.

*Herba* 30-40 cm. alta, basi ramosa. *Caules* vel rami erecti, basi 3-5 mm. crassi, glabri vel unifariam puberuli. *Folia* petiolata, erecta vel adscendentia, glabra; petiolus 1.5-7 cm. longus; lamina 6-15 cm. longa, 3-6 mm. lata, linearia, utrinque acuta, marginibus scabris leviter undulatis. *Umbellae* sessiles vel inferiores pedunculatae, 4-5-florae. *Pedicelli* 1.2-1.5 cm. longi, minute puberuli. *Sepala* 4 mm. longa, 2 mm. lata, ovata, acuta, tenuiter puberula. *Corolla* fere ad basin 5-loba, glabra, virescens ut videtur; lobi patuli, 6-7 mm. longi, 3-3.5 mm. lati, oblongo-ovati, acuti, concavi. *Coronae* lobi columnae staminum aequilongi, erecti, 3.5-4 mm. longi, 2.5-2.8 mm. lati, oblongi, apice rotundati, emarginati, plani ecarinati.

SOUTH AFRICA. Little Namaqualand: on the Khamiesberg Plateau, 1500 m., *Pearson* 6560.

The corolla appears to have been greenish and the coronal lobes ochreous, with a broad median fuscous stripe.

1475. *Cynanchum Pearsonii*, N. E. Brown [Asclepiadaceae-Cynancheae]; affinis *C. Meyeri*, Schltr., sed foliis angustioribus lanceolatis, corollae lobis angustioribus et acutioribus, corona diversa et stylo apice exserto differt.

*Frutex* lignosus, ramosus, 1-1.3 m. altus. *Rami* late divaricati, subrecti vel leviter sursum curvati, nec recurvi, primum minutissime cano-tomentosi, demum subglabri, pallide brunneo-ochracei. *Folia* patula vel deflexa, breviter petiolata, carnosa; 0.6-1.5 cm. longa, 2.5-5 mm. lata, lanceolata vel oblongo-lanceolata, acuta, basi, rotundata vel cuneata, primum minutissime puberula, demum glabra. *Flores* minuti, ad apices axium simplicium vel bifurcatorum parvorum gradatim elongatorum breviter pedunculorum et 3-8 mm. longorum dispositi, sub-

sessiles vel brevissime pedicellati. *Sepala* 1 mm. longa, lanceolata, acuta, minute peberula. *Corolla* 2·5 mm. diametro, glabra; tubus 0·5 mm. longus; lobi 1·5 mm. longi, lanceolati, acuti, adscendentes, apice patuli. *Corona* campanulata, ad medium 5-loba; lobi ovati, acuti, intra basin bicarinati. *Stylus* ad apicem obtuse conicus, antheris multo longior.

SOUTH AFRICA. Great Namaqualand; in sand and crevices in granite near hilltop north of Rotkuppe station, *Pearson* 4466.

1476. ***Microlooma rotkuppense***, *N. E. Brown* [Asclepiadaceae-Cynancheae]; affinis *M. Burchellii*, *N. E. Br.*, sed ramis crasrioribus et floribus duplo majoribus facile distinguitur.

*Frutex* compactus, ramosissimus, 30–60 cm. altus, subaphyllus. *Rami* 2–3 mm., crassi, glabri. *Folia* celeriter decidua, brevissime petiolata, 4–5 mm. longa, 1–1·3 mm. lata, lineari-oblonga, obtusa, basi rotundata vel subcordata, minutissime puberula. *Flores* fasciculati. *Pedicelli* 1 mm. longi, minute puberuli. *Sepala* 4 mm. longa, linearia, acuta, minute puberula. *Corolla* tubulosa, apice conico-acuta, haud dilatata, 5-angularis, extra minutissime puberula, intra superne glabra, inferne fasciculis quinque pilorum instructa; tubus 6 mm. longus; lobi 2 mm. longi, connivento-erecti, compresso-ovati, acuminati, concavi. *Corona* nulla. *Folliculi* solitarii (semper?), 3–5 cm. longi, fusiformi, acuminati, glabri. *Semina* 5–6 mm. longa, ovata, plano-convexa, rugosa, rubescentia.

SOUTH AFRICA. Great Namaqualand: mountains near Rotkuppe, *Pearson* 4192, 4462.

1477. ***Microlooma viridiflorum***, *N. E. Brown* [Asclepiadaceae-Cynancheae]; affinis *M. Massoni*, *Schltr.*, sed foliis longioribus, floribus subduplo longioribus et corolla apice rotundata nec truncata facile distinguitur.

*Frutex* circa 30 cm. altus, ramosus. *Rami* 1·5–2 mm. crassi, velutini. *Folia* brevissime petiolata, 5–8 mm. longa, oblonga vel deltoideo-oblonga, acuta vel obtusa et apiculata, velutina. *Flores* fasciculati. *Pedicelli* 1–2 mm. longi, velutini. *Sepala* tubo corollae aequilonga vel subduplo breviora, 2·5–4·5 mm. longa, lanceolata vel lineari-lanceolata, acuta, velutina. *Corolla* subercolata, apice dilatata, obtuse rotundata, vix apiculata, 5-angularis, extra minutissime puberula, intra superne sparsissime puberula, inferne fasciculis quinque pilorum instructa, viridis; tubus 3·5–4 mm. longus; lobi 1·3 mm. longi, connivento-incurvi, compresso-cucullati, acuti, minute ciliati. *Corona* nulla.

SOUTH AFRICA. Great Namaqualand; sandy plains about 11 miles west of Aus, *Pearson* 4205.

1478. ***Schoenoxiphium Basutorum***, *Turrill* [Cyperaceae-Caricoideae]; affinis *S. lanceo*, *Kuken.*, sed foliis angustioribus, rhachillis masculis in spiculis unisexualibus longioribus distinguitur.

*Culmus* 4·7 dm. longus, gracilis, laevis. *Folia* angustissime linearia, apice acute attenuata, usque ad 2·5 dm. longa et 1 mm. lata, margine tenuiter scabrido excepto glabra. *Inflorescentia*



compacte paniculata, usque ad 3.5 cm. longa et 1.3 cm. lata. *Bracteae* inferiores foliosae, usque ad 6 cm. longae, vaginantes, superiores glumaceae, elliptico-ovatae, acuminatae, 7 mm. longae, 3 mm. latae. *Spiculae* propriae usque ad 1.8 cm. longae, partiales usque ad 1.1 cm. longae, interdum androgynae, interdum abortu ♀. *Rhachilla* mascula in spiculis bisexualibus omnino 1 cm. longa, parte inferiore complanata 4 mm. longa, 0.75 mm. lata, in spiculis unisexualibus linearis, complanata, 8.5 mm. longa, 0.75 mm. lata. *Glumae* ♂ oblongo-ellipticae, acutae, 4.5 mm. longae, 1.5 mm. latae. *Utriculi* (prophylla) cylindrici 6.5 mm. longi, 1.25 mm. diametro, ore obliquo hyalino. *Nux* cylindrica, 4 mm. alta, 1 mm. diametro, laevis; stylus cum ramis 6 mm. longus, ramis tribus 4.5 mm. longis.

SOUTH AFRICA. Basutoland: Plateau, Leribe Mount, A. Dieterlen 948.

1479. **Scleria Dieterlenii**, Turrill [Cyperaceae-Caricoideae]; *S. Dregeanae*, Kunth, affinis, sed inflorescentiis hispidis nucibus valde transverse verrucoso-muricatis recedit.

*Rhizoma* verticale, unituberiferum, gracile. *Culmi* erecti, usque ad 2.4 dm. alti, laeves, basi squamis brunneis obtecti. *Folia* linearia, apice acuta, usque ad 10 cm. longa et 2 mm. lata, fere glabra vel pilis hic illic instructa. *Inflorescentia* terminalis, spicata, circiter 3-4 cm. longa; rhachis hispida. *Spiculae* sessiles, 1-4 aggregatae, ambitu oblongo-lanceolatae, 5 mm. longae, 1.75 mm. latae. *Glumae* ovatae vel elliptico-ovatae, acutae vel leviter acuminatae, usque ad 4 mm. longae et 1.75 mm. latae, extra hispidae. *Stamina* 3, filamentis 4.5 mm. longis. *Discus* inconspicuus, tridentatus, 0.5 mm. altus. *Nux* obovoidea, distincte trigona, breviter stipitata, 1.5 mm. longa, 1 mm. diametro, valde transverse verrucoso-muricata.

SOUTH AFRICA. Basutoland: Plateau, Leribe Mount, A. Dieterlen 749.

1480. **Pentaschistis Basutorum**, Stapf [Gramineae]; affinis *P. juncifoliae*, Stapf, sed statura minore, foliorum laminis brevioribus pro rata rigidioribus in facie superiore (sulco) indumento densissimo e pilis longis tenuissimis constituto vestitis, paniculae ramis ramulisque laevibus, spiculis paulo tenuioribus distincta.

*Gramen* perenne, dense caespitosum; culmi erecti, 30-35 cm. alti, glabri, laeves, 2-4 nodi, pro maxima parte vaginis inclusi vel internodiis intermediis 2 vel 1 breviter exsertis. *Foliorum* vaginae perarctae, firmae, nervoso-striatae, glaberrimae, laevissimae, nitentes, infimae persistentes; ligulae linea transversa densissime sericeo-pilosa notatae; laminae admodum rigidae, erectae, filiformes, sectione transversa cylindricae, anguste canaliculatae, ad 15 cm. longae, dorso glaberrimae, laevissimae, in facie superiore a ligula densissime sericeo-pilosae, pilis longis inferne ad margines magis minusve exsertis superne in sulco inclusis. *Panicula* angusta, 5-10 cm. longa, erecta; rami uti axis laeves, ad axillas piloso-barbati, pro parte brevi indivisi, inaequales, tenuiter filiformes, inferiores ad 4 cm. longi; ramuli pedicellique subcapillares, laeves; pedicelli laterales breves.

*Spiculae* albidæ, ima basi purpurascens, 9 mm. longæ. *Glumæ* lanceolatae, a latere visæ acute longiuscule acuminatae, hyalinae, glabrae, 1-nerves, in carina laeves. *Valvæ* oblongæ, ad aristæ insertionem 3·5–4 mm. longæ, undique laxè pilosæ, tenuissime sub-9-nerves, lobis acutis 0·5 mm. longis, setis laterilibus 6–7 mm. longis, arista 1·3–1·4 cm. longa ad 3·5 mm. torta columniformi, callo brevi breviter piloso. *Paleæ* apice 2-dentatæ vel 2-mucronulatæ, 4–5 mm. longæ, subglabrae. *Antheræ* 3·5 mm. longæ, purpurascens.

SOUTH AFRICA. Basutoland: in the Veld near Leribe, A. Dieterlen 222. Lingua Sesotha:—Molälaoa hlolo.

## V.—GREEN MANURES.

An account, by Mr. W. M. van Helten, of experiments carried out in Java during the past four years with various plants as green manures, has recently been published in Buitenzorg as No. 1 of Mededeelingen uit den Cultuurtuin,\* and has been sent to Kew by the Director of the Department of Agriculture at Buitenzorg.

Some fifty-three different species of plants have been experimented with in connection with their value as cover plants for the soil and as green manures, in order to mitigate the poverty of the soil brought about by clean-weeding and the denudation of the soil by rain.

Of the numerous plants tried, many were found unsatisfactory in some particular, but six of them are to be recommended as a result of the trials.

Particulars of these six plants have been translated from the Dutch and now follow.

The original paper is illustrated by excellent figures of the various cover crops growing on an extensive scale in Java.

### *Leucaena glauca*, Benth.

(*Lamtoro*, *Peteh tjina*, *Kamlandingan*.)

This is one of the oldest manurial plants under trial; it has been used about six years in the gardens and it still gives great satisfaction. The *Leucaena* or *Lamtoro* can be used in different ways, the growth should be kept in check according to the plants cultivated. In young coffee plantations it should be kept down, but it may be grown higher underneath *Hevea*, *Ficus*, and *Cocconut* palms. *Lamtoro* requires fairly good soil; it does not grow much more than six inches and looks very sickly in poor soil.

In West Java the growth is not as vigorous as it is in the East and in Middle-Java. *Lamtoro* may be planted from sea-level up to 3500 feet. It was noticed that seeds germinated better and grew more quickly, when they were sown at the end of the East-monsoon, than did those which were sown in the full rainy

\* Mededeelingen uit den Cultuurtuin, No. 1. De Resultaten, verkregen in den Cultuurtuin met verschillende groenbemesters, door W. M. van Helten, Buitenzorg, 1913. 0.60 fr. G. Kolff & Co., Batavia.

season. Lamtoro produces plenty of seed, but it soon loses its capacity for germination. One cannot count upon more than 50 per cent. germination after the seed has been kept for four or five months. The seed may be sown in lines as well as scattered in the plantation. In Coffee and Hevea plantations it is advisable to sow the seed at once in broad bands between the trees. The seed will germinate in about a week's time. As long as the soil remains uncovered, weeding about every three or four weeks will be needed. Pruning can be done at intervals of three or five months. The *Leucaena* is not much attacked by blight or fungi, and it will also grow fairly well in half shade. One of the faults of this plant is that the leaves do not last long; the fine leaflets decay after a few days and only the branches and leaf stems remain.

For this reason the Lamtoro is not very effective as a covering for the soil, and it does not protect the plants among which it may be growing against drought as well as does *Clitoria cajanifolia*, the next plant to be described.

### ***Clitoria cajanifolia*, Barth.**

(*Soend: Katjang tjepel of Kakatjangan.*)

This plant grows best below 2000 feet and is one of the best for covering the soil; it is also much used to plant on terraces to prevent the soil from washing away. It lives long and stands cutting very well. In plantations, where it has been sown for three years, it does not seem to die away or lose its vitality. One great advantage of this plant is, that when it has been cut down, it spreads itself over the ground. The sowing is rather troublesome, as the seeds are very sticky and adhere to the fingers. The seed should be sown in lines, half a pod in each hole, and they should not be washed before sowing, because they do not germinate very well after washing. The quickest way in which a piece of ground may be covered is by sowing the seed in lines from six to twelve inches apart, after about four months the soil will be covered and the plants can then be cut over every four or five months.

*Clitoria* is recommended for planting in Hevea and Coffee Plantations. One great advantage of this plant is, that the leaves are tough and last a long time. If the leaves be cut in the dry season and laid round the Coffee plants and Hevea trees, they will last a long time and the plants will not suffer much from drought; the plants also frequently put out a crop of fresh leaves when they have been cut over.

*Clitoria* like Lamtoro does not suffer from insect pests or fungal diseases.

A further point in favour of this plant is that neither the leaves nor seeds are eaten by human beings or animals.

### ***Tephrosia* spp.**

Three *Tephrosias* have been tried, namely, *Tephrosia candida*, *T. Hookeriana* var., *amoena* and *T. Vogelii*.

The great value of the *Tephrosias* apart from their other good qualities is that they do better in soil of poor quality than do *Leucaena* or *Clitoria*.



**Tephrosia Hookeriana**, *Wight & Arn.*, var. **amoena**, *Prain*, (often but wrongly called *T. purpurea*), has been grown in our Gardens for about seven years and has always given great satisfaction. It produces many leaves and may be cut two or three times, at intervals of five months, before it dies. The seed may be sown in lines or spread broadcast. If sown in lines they should be eighteen inches apart.

*T. Hookeriana*, var. *amoena*, produces many seeds, which will germinate even after they have been kept for a long time; 80 per cent. of seed, as much as a year and a half old, was found to germinate. The young plants will not stand much rain, and it often happens that a young plantation will die away after rain has fallen for a couple of days.

If the plants have reached a height of about a foot, however, they are not nearly so susceptible to damp off with excess of rain.

It has also been noticed that seed kept for two or three months under favourable conditions will germinate more quickly than freshly gathered seed. Seed germinates in a few days and the soil becomes entirely covered by the crop in about three months' time from sowing. During the first three months the plantations should be weeded once or twice.

This *Tephrosia* grows very well from 600 to 2000 feet above sea-level, and will also stand some shade. Plants partly in the shade were not quite so vigorous as plants in full sun. As long as the plant is young, it does not suffer from the stem disease "djamoer oepas."\* This disease sometimes attacks the plants when the stems become more woody. It seems that this disease does not attack the plants to such an extent if each time they are pruned larger portions of the stems are left standing.

### ***Tephrosia candida*, DC.**

This plant is even better than the former species for green manuring purposes, since its growth is more vigorous and the leaves are much larger and very hairy on the underside. The seed, which should be sown in lines a foot apart, germinates in about a week's time, and the soil should be covered by the crop in about three or four months. If the plants, when they have grown to a height of 18 ins. to 2 ft., be cut down to a height of 9 ins. above the level of the soil, they will become more spreading in habit and send out branches from the lower part of the stem. Later on they can be cut every three or four months. *T. candida* can withstand considerable drought and frequent pruning; it has many leaves, which last a long time and form a good covering to the soil. The plants also live for a long time, and up to the present have been found to be almost the best for use as green manure.

*T. candida* may be used in Coffee and Hevea plantations, and it is also a very suitable cover crop for ground that is rather poor in quality, or for fresh-cleared land. Plants of two years standing did not appear to have lost their vigour, and no sign of *Corticium* was to be found on them.

---

\* "Djamoer oepas" is a well recognised stem disease, caused by *Corticium salmonicolor*, B. (C. *javanicum*, *Zimm.*).

**Tephrosia Vogelii, Hook. f.**

This is a useful species, but not of so much value as the ones already mentioned.

**Desmodium gyroides, DC.**

(*Potang koedjang bodas*).

This plant is the most valuable of the many species of *Desmodium* known to us at present. It grows in bushy form and produces many leaves; it can also be cut to any height, and lives a long time. *D. gyroides* is to be found in the neighbourhood of Plaboean-ratoe, up to 2500 feet. It produces a quantity of seed, which is very small, and it is therefore advisable to sow it in lines. The seed will germinate in about a fortnight. One drawback to the use of this plant, however, is that often many of the young plants die shortly after they appear above the ground for some reason which has not yet been satisfactorily explained.

This *Desmodium* is considered to be a very good manurial plant for Coffee and Hevea plantations, since it produces numerous leaves, which form a fairly thick humus layer. It does not suffer from any disease; the only fault to be found with it is, that some of the plants, after being pruned a couple of times, may be attacked by *Corticium salmonicolor*. If the injured plants be removed immediately, however, there is no fear of any harm being done to the cultivated plants.

**Indigofera Anil, Linn.**

This plant is of a bushy habit. The seed is very small, and is sown in lines eighteen inches to two feet apart; it will germinate in about seven to nine days. When first the seedlings show above ground it is almost impossible to weed amongst them, but after a month to a month and a half the difference between plants and weeds becomes sufficiently distinct for the weeds to be identified. The plantation will be covered with a dense growth after three or four months, and the plants can be cut back after six or seven months.

The plant lives about two-and-a-half years.

Another *Indigofera* (*I. hirsuta*) has also been tried, but it does not live so long as *I. Anil*, and as it can only be cut once it has not proved as useful as that species.

**VI.—DECADES KEWENSES**

PLANTARUM NOVARUM IN HERBARIO HORTI REGII  
CONSERVATARUM.

**DECAS LXXXVI.**

741. **Hibiscus pachmarhicus**, Haines [Malvaceae-Hibisceae]; *H. furcata*, Roxb., *H. radiato*, Willd. et *H. Mastersiano*, Hiern, affinis; *H. Mastersiano* autem arctissime affinis; ab *H. curcato* aculeis deficientibus, stipulis angustis, bracteolarum appendiculis minoribus pedunculis brevibus differt; ab *H. radiato*

aculeis nullis, foliis nunquam palmatifidis et margine minus serrato recedit; ab *H. Mastersiano* floribus majoribus, bracteolis appendicula minore instructis, calycis lobis longioribus angustioribusque (*H. Mastersiani* calycis lobi vix 9 mm. longi, acuti, non acuminati sunt), foliis serratis (in *H. Mastersiano* folia crenato-dentata sunt), setis stellatis numerosis differt.

*Herba* erecta, 0.6–1 m. alta, setis stellatis basi tuberculatis instructa, non aculeata. *Folia* submembranacea, inferiora rotundata vel ovata, 8–10 cm. diametro, superiora ovata vel lanceolata, summa lineari-oblonga, omnia impariter serrata pilisque stellatis pagina utraque tecta; petioli infimi circa 7 cm. longi, superiores breves; stipulae 1 cm. longae, lineari-setaceae.



1. Part of stem. 2. Bracteoles and calyx. 3. Bracteole.  
4. Seed—nat. size. 5. Seed—mag. 6. Small scale from seed.  
7. Large scale from seed.

*Flores* axillares, subsessiles, 4–5 cm. longi, flavi, in mediis purpurei. *Bracteolae* 10, ima basi inter se connatae, a calyce liberae, 1 cm. longae, setosae pilosaeque, lineares, appendiculatae, parte supra appendiculam lineari sub-terete obtusa appendiculae subaequilonga; appendicula bracteola parum latior, lanceolata. *Calyx* 1.2 cm. longus, 10-costatus, setosus pilosusque, lobis tubo longioribus lanceolatis acuminatis. *Capsula* ovoidea, rostrata, calycem longitudine subaequans, juventute pilis longis rigidis albis densissime instructa; semina acutangularia, verrucarum ordinibus squamisque ovatis pectinatis obducta.

INDIA. Central Provinces: common in the middle Gondwana sandstones about Pachmarhi in the Satpura range, 900 m., Haines 197 P. Flowers and fruits October–November.



The scales on the seeds are very pretty objects under the microscope, much resembling scallop shells of which the ridges are produced into free ends.

*H. Mastersianus* was founded on Dr. Welwitsch's sheets Nos. 4927, 4928 and 5242. Hiern also doubtfully includes a tomentose form (sheet No. 5241), but states that the seeds of this are glabrous, smooth and shining, whereas the seeds of the others are slightly or sparingly papillose. Nothing is said of the scales in any of the forms. The writer has not attached so much importance to this difference, because it is found that both the scales and the papillae (or minute warts) are of late formation and occur in fertile seeds only.

Apart from this character, however, it would appear that the small-leaved, often tomentose, plants on sheets 4927 and 4928 are different species to that on sheet 5242 which comes nearer to *H. pachmarhicus*, although the flowers are only 1.9 cm. long. But the plant at Kew which most nearly approaches *H. pachmarhicus* appears to be F. A. Rogers, No. 7007 (Flora of N.W. Rhodesia), which is said to be "common all along the line." This has very scaly seeds and may be the same species. Mr. Sprague and Mr. Baker, who have kindly looked into the matter, both consider *H. pachmarhicus* distinct from *H. Mastersianus*, and Mr. Sprague, who has placed the sheet (No. 7007) referred to as near *H. Mastersianus*, informs me that the peculiar distribution entailed, if No. 7007 is really *H. pachmarhicus*, is not without parallel among other species of the genus (e.g., *H. caesioides*, Garcke).

Hochreutiner describes his "*H. surratensis*, var. *Mastersianus*" (to which he reduces *H. Mastersianus*, Hiern) as "*aculeis minimis numerosis*," but it seems to the writer that these are merely the stellate bristles of which only a single barb remains on the tubercled base, and that *H. Mastersianus* has no prickles comparable with those on *H. surratensis*.

742. *Crotalaria* (*Diffusae*) *Fysonii*, Dunn [Leguminosae-Genisteae]; *C. evolvuloides*, Wight, affinis, floribus bis majoribus foliisque nunquam attenuatis distincta.

*Herba* perennis, diffusa, basi sublignosa. *Caules* multi, pauciramosi, ascendentes, 20-30 cm. longi, ut folia utrinque et pedunculi pedicelli calyces et legumina breviter molliter hirsuta. *Folia* simplicia, late ovata, apice rotundata vel rare breviter obtuse apiculata, basi oblique subcordata (1-) 1.3-1.8 (-3) cm. longa, brevissime petiolata, integra, subcoriacea, pilis in pagina superiore basi bulbosis, inferiore saepe stellatis, margine tomentosa, venis marginem approximantibus 3-4-jugis; stipulae lineares, persistentes, 1-2 mm. longae. *Racemi* terminales et foliis oppositi, pauciflori, 8-12 cm. longi, longe pedunculati. *Flores* 1.5-1.7 cm. longi, laete flavi, ante et post anthesin rubidi, pedicellis 5-7 mm. longis medio bibracteolatis, bracteis persistentibus 2 mm. longis. *Calyx* paullo bilabiatus, 1 cm. longus, lobis linearibus acutis tubo longioribus. *Corolla* lineata, calyce sesquilongior; vexilli lamina rotundata, reflexa, basi auriculis duabus inflexis instructa, ungue brevi; alae oblongae, in unguem brevem abrupte angustatae; petala carinae rostrata, antice anguste tomentosa. *Ovarium*

stipitatum, pubescens. *Legumen* cylindricum, 2·5–3 cm. longum, 6 mm. latum, calycem 3–4-plo excedens.

S. INDIA. Madura Dist., Palni Hills, Kodaikanal Downs, flowering from May to September, *Fyson* 276, 1072, 1846; Travancore, Devicolam, 2130 m., *Meebold* 13,268; Mysore City, 915 m., *Meebold* 11,395.

743. *Lathyrus Sargentianus*, *Craib* [Leguminosae-Vicieae]; a *L. Wilsonii*, *Craib*, floribus minoribus facile distinguendus.

*Caules* volubiles, circiter unimetrici (ex *Wilson*), parce puberuli, plurisulcati. *Folia* fere sessilia, ad 15 cm. longa, rhachi supra canaliculata puberulaque in cirrhum ramosum producta; stipulae foliaceae, acutae, ad 15 mm. longae et 2·5 mm. latae, ciliolatae; foliola plerumque alterna, ad 7-juga, ovato-lanceolata, mucronata, basi late cuneata vel rotundato-cuneata, ad 4 cm. longa et 1·4 cm. lata, membranacea, supra pilis paucis instructa, subtus pallidiora, glabra nisi costa parce puberula, ciliolata, nervis lateralibus circiter 12 satis obliquis intra marginem anastomosantibus; petioluli 1–1·5 mm. longi, supra crispatis puberuli. *Racemi* axillares, pedunculo communi ad 6 cm. longo puberulo suffulti; bracteae persistentes, ad 7 mm. longae; pedicelli circiter 3 mm. longi; flores lutei (ex *Wilson*). *Calyx* 4 mm. longus, lobis 1·5 mm. longis. *Vexillum* 13·5 mm. longum, 6·5 mm. latum; alae 6·5 mm. longae, ungui 6·5 mm. longo, auricula brevi; carina 6 mm. longa, 3·5 mm. lata, ungui 6 mm. longo. *Legumen* ad 3·5 cm. longum et 9 mm. latum, stramineum, stipite circiter 5 mm. longo suffultum; semina 5 mm. longa, brunnea, fusco-maculosa.

CHINA. Western Hupeh, *Wilson* 265 (1907); Fang, *Wilson* 1234 (1901). Western China, *Wilson* 3432 (1904).

744. *Lathyrus Wilsonii*, *Craib* [Leguminosae-Vicieae]; a *L. Davidii*, Hance, foliolis stipulisque minoribus, floribus paucioribus recedit.

*Caules* volubiles, primo flexuosi, glabri, straminei, sulcati. *Folia* ad 6·5 cm. longa (petiolo cirrhoque exclusis), petiolo ad 1·5 cm. longo ut rhachi glabro supra late haud altius canaliculato, cirrho ramoso; stipulae erectae vel divaricatae, foliaceae, ad 1 cm. longae et 2·5 mm. latae, glabrae; foliola 3–4-juga, opposita vel rarius subopposita, oblongo-lanceolata, mucronata, basi cuneata, ad 5·7 cm. longa et 1·8 cm. lata, membranacea, glabra, subtus pallidiora vel fere glauca, nervis lateralibus utrinque circiter 5 obliquis intra marginem anastomosantibus. *Racemi* axillares, laxiflori, pedunculo communi ad 5·5 cm. longo terete glabro suffulti; bracteae deciduae; pedicelli 4 mm. longi. *Calycis* tubus latere inferiore 4 mm. longus, dentibus subulatis, inferiore 1·75 mm. longo lateralibus parum longiore, superioribus brevibus, margine minute rubro-glanduloso. *Vexillum* sub-oblongum, basi late cuneatum, apice emarginatum, 1·7 cm. longum, 8 mm. latum, sessile; alae oblongae, 7 mm. longae, 2·5 mm. latae, auricula obtusa 1 mm. longa, ungui 1·1 cm. longo; carina 8 mm. longa, 4 mm. lata, ungui 1 cm. longo. *Staminum* vaginae os rectum. *Ovarium* 9 mm. altum, stipite

3 mm. longo, stylo 5 mm. longo parum compresso facie inferiorem pubescente.

CHINA. Western Hupeh, *Wilson* 4595 (1910); Fang, *Wilson* 2095 (1901).

745. **Begonia** (*Gireoudia*?) *lophoptera*, *Rolfe* [Begoniaceae]; a *B. ciliata*, Oliv. (Bot. Mag. t. 5897) foliis et bracteis majoribus, floribus coccineis et capsulae alis piloso-cristatis differt.

*Herba* erecta, subelata (immatura circiter 30 cm. alta). *Caules* crassiusculi, pilosi. *Foliorum* petioli 3-12 cm. longi, hirsuto-villosi; laminae oblique suborbiculari-ovatae, 6-9 cm. longae, 5-10 cm. latae, obscure lobatae et crebre denticulatae, submembranaceae, supra nitidae, subtus glabrae, pallidae, nervis 5-7 radiantibus hirsutis vel pubescentibus; stipulae ovato-oblongae, denticulatae, 1.5-2.5 cm. longae. *Pedunculi* 6-8 cm. longi, suberecti, 8-12-flori, hirsuto-villosi, coccinei. *Flores* coccinei, extra hirsuto-villosi. *Flores* masculi: perianthii phylla 2, patentia, late elliptica, obtusa, 1-1.5 cm. longa; androecium globosum, 5 mm. longum; stamina brevissime monadelpha; antherae lineares, filamentis longiores, fissuris lateralibus. *Flores* feminei non visi. *Capsula* pendula, hirsuto-tuberculata, inaequaliter 3-alata; alae laterales late triangulares, subobtusae, 8 mm. longae, ala terminalis late oblonga, crassiuscula, 1.3 cm. longa, apice truncata et cristata; styli decidui.

PERU. Pozuzu, *R. Pearce* 556. Mayobamba district, *Forget*.

Originally discovered by Richard Pearce, who collected in the Andes for Messrs. James Veitch & Sons between 1862 and 1866, and afterwards introduced by L. Forget, who sent it to Messrs. Sander & Sons, in whose establishment at St. Albans it flowered in April, 1911. The flowers are of a vivid scarlet, and the upper wing of the fruit terminates in a remarkable thickened toothed and pilose crest, in allusion to which the name is given. In the absence of female flowers the affinity is somewhat doubtful.

746. **Mycetia** *Parishii*, *Craib* [Rubiaceae-Mussaendeae]; a *M. longifolia*, K.Sch., stipulis brevibus, foliis pagina utraque reticulatis, nervis lateralibus bene intra marginem anastomosantibus, sepalis integris, a *M. cauliflora*, Reinw., inter alia corollae lobis longioribus recedit.

*Frutex* altus (ex *Beddome*), ramulis primo densius puberulis mox glabris cortice brunneo plus minusve longitudinaliter reticulato-striato obtectis ad 4 mm. diametro. *Folia* saepe parum inaequilatera, lanceolata, ovato-lanceolata vel plerumque oblanceolata vel obovato-oblanceolata, apice acute acuminata, basi cuneata vel attenuato-cuneata, 10-21.5 cm. longa, 2-7.3 cm. lata, chartacea vel membranaceo-chartacea, pagina superiore glabra, inferiore costa nervisque puberula, nervis lateralibus utrinque 12-15 intra marginem anastomosantibus cum costa supra prominulis subtus valde prominentibus, nervis transversis supra conspicuis subtus prominentibus, nervulis uti reticulatione gracili subtus subprominulis; petioli usque ad 1 cm. longi, supra canaliculati, indumento ut ramuli; stipulae deltoideae, circiter 2 mm. longae et 2.5 mm. latae. *Inflorescentia* et cymis paniculatim dis-



positis composita, ad 5 cm. longa et 6 cm. diametro, pedunculo communi perbrevis vel usque ad 7 mm. longo suffulti, pedunculis rhachi pedicellisque puberulis; pedunculi partiales ad 1 cm. longi, ultimi 4-5 mm. longi; bracteae parvae. *Receptaculum* 2 mm. altum, glabrum. *Calycis* segmenta deltoidea, subacuta, 1.25 mm. longa, puberula. *Corollae* luteae (ex *Parish* et *Beddome*) tubus 1.3 cm. longus, intra parce albo-pilosus, lobi oblongi, ad 3.5 mm. longi et 1.25 mm. lati. *Stamina* corollae tubi ad basem inserta, filamentis brevibus, antheris 2 mm. longis. *Stylus* 1 cm. longus, pilis paucis instructus, ramis 4 mm. longis. *Fructus* 3.5-4 mm. diametro.

INDIA. Lower Burma: Moulmein, *Parish* 1026; Papun, *Meebold* 17,029, 17,366; Tenasserim, Mooleyit, 900 m., *Beddome* 5.

After a careful examination of the specimens of this genus the writer is convinced that *Adenosacme longifolia*, Wall., var. *sinensis*, Hemsl., should be raised to specific rank under the name *Mycetia sinensis* and that it is necessary to restore Wallich's name for the Malay Peninsula plant *Adenosacme malayana*, Wall. = *Wendlandia malayana*, Don, thus becoming *Mycetia malayana*. It is necessary also to make the combination *Mycetia chasalioides* for *Adenosacme chasalioides*, Craib.

747. *Ixora Meeboldii*, Craib [Rubiaceae-Ixoreae]; ab *I. pendula*, Jack, inflorescentia longe pedunculata eiusque ramis brevibus recedit.

*Suffrutes* vix metralis (ex *Lobb*), inflorescentia excepta glaber, ramulis primo compressis mox teretibus 2-3 mm. diametro cortice primo stramineo mox cinereo-brunneo obtectis. *Folia* late oblanceolata vel fere oblongo-oblanceolata, apice acuminata, acuta, basi cuneata, 10.5-18 cm. longa, 3.5-6 cm. lata, chartacea vel rigide chartacea, nervis lateralibus utrinque circiter 8 pagina superiore conspicuis vel subprominulis inferiore cum costa prominentibus, nervis transversis pagina utraque prominulis vel subprominulis, margine parum recurvo, petiolo 0.5-1.2 cm. longo supra canaliculato suffulta; stipulae cuspidato-acuminatae, 3.5-6 mm. longae, dorso plus minusve carinatae. *Inflorescentia* corymbiformis, ad 4 cm. diametro, pedunculo communi 6-11 cm. longo basin versus hibracteato suffulta; bracteolae 1.5 mm. longae, dorso puberulae; flores albi (ex *Lobb*). *Receptaculum* 1 mm. altum, puberulum. *Calycis* segmenta deltoidea, acutiuscula, 0.75 mm. longa, ciliolata, dorso puberula. *Corollae* tubus 2.2 cm. longus, 0.75 mm. diametro, extra parvissime puberulus, intus glaber; lobi reflexi, 4 mm. longi, 2.75 lati, margine recurvo. *Filamenta* 0.75 mm. longa, antheris 2.5 mm. longis connectivo producto apiculatis. *Stylus* glaber. *Fructus* saepius monospermus, ad 8 mm. altus, 6-8 mm. diametro, sicco rubescens.

INDIA. Lower Burma: Moulmein, 600 m., *Lobb*; Papun, *Meebold* 17,349. Martaban, Wall. Cat 8387 (*Psychotria*?).

var. *oblonga*, Craib, a typo foliis ad 25.5 cm. longis et 5.7 cm. latis oblongis vel elongato-oblongo-lanceolatis differt.

INDIA. Lower Burma: Moulmein, Papun, *Meebold* 17,344, 17,345.

748. **Exacum Saulierei**, *Dunn* [Gentianaceae-Exaceae]; ab *E. zeylanico*, Roxb., calycis alis angustis et foliis 5-7 nervibus distincta.

*Herba* robusta, glabra, 1 m. alta, ramosa. *Caules* cylindrici, laeves. *Folia* opposita, sessilia, ovata, breviter acuminata vel acuta, palmatim 5-7-nervia; paria distantia. *Flores* speciosi, solitarii, axillares et terni, terminales; pedicelli 3-4 cm. longi, medio bracteolis 2 foliaceis 1-2 cm. longis muniti. *Calyx* 0.8-1 cm. longus; lobi 5, tubo aequales, acuminati, dorso carina crassa 1.5 mm. alta alati. *Corolla* expansa rotata, 5-6 cm. diametro, lobis linear-oblongis 2.5 cm. longis apice rotundatis. *Stamina* 5, in fauce inserta, cum dentibus parvis alternantia; filamenta breviter; antherae erectae, 5-6 mm. longae, poris apicalibus dehiscentes. *Ovarium* ovoideum, subito acuminatum, biloculare; stylus stamina superans, deflexus.

INDIA. Madras Presidency: Madura District, *Saulière* 69.

749. **Christisonia Saulierei**, *Dunn* [Orobanchaceae]; affinis *C. tubulosae*, Wight, floribus minoribus, pedicellis bracteis vix superantibus distincta.

*Herba* erecta, 30-40 cm. alta, parasitica, ubique praeter flores glaberrima. *Caules* simplices, 5 mm. crassi. *Folia* squamis paucis distantibus suboppositis oblongis 1 cm. longis substituta. *Racemi* pauciflori, breves, terminales; pedicelli erecti, 1-2 cm. longi; bracteae oblongae, 1-1.5 cm. longae. *Calycis* glabri tubus cylindricus, paullo bilabiatus, 1.5-1.7 cm. longus, 5-7 mm. latus, 5-lobatus; dentes 3 superiores 2 mm. longi, triangulares, acuti, sinibus 4 mm. altis a dentibus duobus inferioribus divisi. *Corolla* tubulosa, 3.5-4 cm. longa, 5 mm. lata vel paullo infra faucem inflata, extra tenuissime puberula, intra circum staminum insertionem tomentella; lobi 5, late ovati, 3-5 mm. longi, patuli, vel paullo reflexi. *Stamina* 4, didynamia, infra medium tubi inserta, inclusa; filamenta inferius pubescentia; antherarum loculi 2, inaequales, connectivo dependentes, basi caudati, majore ovato per totam longitudinem dehiscente, minore tenui sterili. *Ovarium* lanceolatum, paullo compressum, quasi 2-loculare, stylo incluso; stigma peltatum.

INDIA. Madras Presidency: Madura District; Kodaikanal, 2040 m., *Saulière* 142.

750. **Betula Wilsonii**, *Bean* [Betulaceae]; species in genere ob folia plurinervia hirsutaque insignis.

*Frutex*, 1.5-3 metralis, ramis imis prostratis; ramuli hornotini pilis adscendentibus-appressis pallide fuscis dense induti, annotini glabri, parum verrucosi. *Folia* decidua, ovata, acuta, basi rotundata vel cuneata, margine irregulariter saepiusque bis serrata, 2-5.5 cm. longa, 1-2.5 cm. lata, supra viridia; hebetia, nisi secus nervos hirsutos glabrescentia, subtus praesertim secus costam nervosque pilis longiusculis sericeis fuscis induta; nervi utrinsecus 12-22, paralleli, supra manifeste impressi, subtus elevati; petiolus 2-3 mm. longus, sericeus; stipulae ovato-oblongae, 4 mm. longae, hirsutae. *Amenta maris* 1.3 cm. longa; squamae concavae, orbiculares, extra et in margine hirsutae, intus glabrae, atro-fuscae, nitentes. *Amenta feminea* 2 cm. longa;

squamae 3-lobae, 2.5 mm. longae, lobo centrali ovato-oblongo lateralibus rotundatis duplo vel plus quam duplo longiore ciliato.

CHINA. Szechuan; Wushan; 2100—2700 m., *Wilson* 1140.

A very distinct dwarf birch, introduced to cultivation in 1909. In his field-note *Wilson* describes the plant as "6 ft. to 10 ft. high, hanging down over cliffs: June and October, 1908."

## VII.—MISCELLANEOUS NOTES.

MR. HARRY BARRON SHARPE, formerly a member of the gardening staff of the Royal Botanic Gardens, has, we learn, been appointed Plant Import Inspector in the Agricultural Department, British East Africa.

**Additions and alterations to Gardens, 1913.**—Additions to the collections of plants cultivated at the Royal Botanic Gardens, Kew, have been made during the year by exchanges with other gardens, private as well as public, and by purchase from nurserymen and others. Contributions of plants and seeds received from Botanic Gardens and other institutions include the following:—

Brisbane—Orchids.

British East Africa—Native seeds.

Brussels Botanic Garden—Stove plants and Orchids.

Brussels Colonial Garden—Wardian case of Congo plants.

Buenos Aires—Collection of seeds.

Calcutta—Rhizomes of *Hedychium coronarium* for distribution; bulbs of *Lilium nepalense*.

Canadian Department of Agriculture—Seeds of *Zizania*, &c.

Ceylon—Rhizomes of *Hedychium coronarium* and *H. flavescens* for distribution.

Dominica—Various seeds.

Nigeria, Northern—Seeds of *Kerstingiella geocarpa* and *Voandzeia subterranea*.

St. Petersburg—Large plant of *Osmunda regalis* (see *Kew Bull.*, 1913, p. 359).

Saharanpur—Various seeds.

Saigon—Various seeds.

Singapore—Three Wardian cases of plants; palm and other seeds.

Sydney—Collection of native seeds.

Trinidad—Wardian case of plants; seeds.

United States Department of Agriculture—Collection of seedling Crotons; seeds.

Virgin Islands—Plants of *Mamillaria nivosa*.

Exchanges were made with the Botanic Gardens of Edinburgh, Glasnevin, Cambridge and Oxford, and with most of the European gardens upon which Kew is largely dependent for seeds of those annual herbaceous plants which fail to produce seeds at Kew.



Other donations to the Gardens include the following:—

Dr. Appleford, Hoddesdon—Plant of *Impatiens Jerdoniae*.

Mr. F. M. Bailey, C.M.G., Brisbane—Plants and seeds.

Mr. F. R. S. Balfour, Dawyck—Collection of British Columbian seeds.

Canon Ellacombe, Bitton—Plants and seeds.

Messrs. H. J. Elwes and W. R. Price—Plants and seeds from the Far East.

Lt.-Col. Sir E. Grogan, Bt., Santiago—"Yareta," fuel plant from the High Andes.

Messrs. Haage & Schmidt, Erfurt—Collection of seeds.

Lady Hanbury, La Mortola—Succulent plants; collection of seeds.

Dr. J. C. Harvey, Mexico—Plants of *Cypripedium Irapeanum*; seeds.

Lt.-Col. Sir G. Holford, Tetbury—Collection of Orchids (see *Kew Bull.*, 1913, p. 192.)

Rev. A. Miles Moss, Para—Brazilian Aristolochias.

Prof. H. H. W. Pearson, Cape Town—Bulbs and succulent plants.

Dr. G. V. Perez, Teneriffe—Seeds of Canary Island plants.

Mr. N. S. Pillans, Cape Colony—Succulent plants.

Mr. J. C. Quinn, Para—Seeds of *Manihot* spp.

Hon. N. C. Rothschild, Oundle—Collection of Bornean orchids.

Messrs. Sander & Sons, St. Albans—Large collection of stove plants; orchids.

Mrs. Sheppee, Bracknell—Collection of tropical orchids (see *Kew Bull.*, 1913, p. 359.)

Mr. C. M. Stuart, Kobe—Seeds of *Viscum album* var. *coloratum*.

Mrs. P. M. Sykes, Jersey—Seeds and bulbs collected in Persia.

Messrs. J. Veitch & Sons, Ltd.—Stove and greenhouse plants.

Mr. R. Whittle, Ascot, Queensland—Bulbs of *Eurycles amboinensis* and *E. Cunninghami*.

Miss Willmott, Great Warley—Collection of mossy saxifrages, &c.

Mr. O. O. Wrigley, Bury—72 *Clivias* in large pots.

Mr. P. H. Browne, Sutton, Mr. J. A. de Lastia, Panama, Mr. C. H. Lankester, Costa Rica, the late Sir Trevor Lawrence, Bt., Burford, Mr. A. C. Miles, Gold Coast, Mr. E. C. Ollenbach, Ootacamund, and Messrs. Stansfield & Hodgkin, Madagascar—Orchids.

Among the plants and seeds of interest distributed from Kew during the year were the following:—*Cytisus Dallimorei*, *Hedychium coronarium* (in quantity to Colonial Botanic Gardens), *Hedychium* species and hybrids (various), *Kerstingiella geocarpa* (seeds) and *Voandzeia subterranea* (seeds), *Nothofagus obliqua*, *Rhamnus Purshiana*, *Tillandsia reginae* (seeds), *Viscum album*, var. *coloratum* (seeds), and Chinese plants of recent introduction (various).

Wardian cases of plants were sent to Ceylon, Dominica, Hong Kong (2), Singapore (2), Uganda (2), and the Colonial Garden, Brussels.

Surplus trees, shrubs, and herbaceous plants were presented to public institutions.

There was a large demand for seeds ripened at Kew and offered for distribution in *Bulletin*, Appendix 1, 1913.

Among alterations and improvements carried out during the past year the following were the more important:—Continuation of re-making the Rock Garden. Re-roofing North Octagon of Temperate House. Re-arrangement of heating system of No. 1 House. The central portion of the Temperate House was repainted inside, as also were a number of smaller houses.

**Riverside Avenue.**—The work of providing a new screen of evergreen vegetation to hide the unsightly parts of Brentford from the view of visitors in the north-west part of the gardens, which was begun last winter (see *K.B.* 1913, p. 51), is being completed. Owing to the number of large evergreens like holm oak, holly and yew that have been needed to make an immediately effective screen of sufficient height, the work has been of an arduous nature—some of the masses of earth moved with the trees weighing four to six tons. Once planted, however, the belt will be not only increasingly effective but permanent.

**New Chinese Rhododendrons.**—The large collection of rhododendrons raised from seeds of Wilson's gathering, and obtained also from Messrs. Veitch, J. C. Williams, Miss Willmott and other donors, having become too large for nursery quarters, it has become necessary to provide space for them in the Ericaceae collection. This is situated on the western side of King William's Temple. One of the "spurs" of the mound on which the temple stands has been cleared of a nondescript mixture of trees and shrubs for their accommodation. There is still the large collection raised from seeds sent home by Forrest to be disposed of during the next few years. It seems probable that before the whole of the Chinese rhododendrons and other new Ericaceae have been found permanent places, most of the ground in this part of the gardens will have to be given up to them.

**Rose Dell.**—The renewal of the roses in this pretty feature of the grounds, which was begun last winter, has been completed. About 350 of the best free-growing or rambling roses have been planted. The removal of a large sweet chestnut that stood in the middle of the dell has given more room for planting and will admit more light and air.

**"Seven Sister" Elms.**—The remnants of two more of these famous elms have had to be removed during the winter. The trees, once of very large size, had become reduced to mere fungus-eaten stumps a few feet high and dangerous to the public. There now remain three of the original seven, two of them lofty trees still vigorous, the other a stump with a propped-up limb on one side only. Judging by an engraving in the *Gardeners' Chronicle* of Sept. 15, 1883, from a drawing by Fitch, six of these elms were

then in good condition. They appear as good-sized trees in an old eighteenth-century engraving preserved in No. III. Museum, standing near the margin of George III.'s lake, which was filled up about 1814.

**Additions to Arboretum.**—The most important contribution to the hardy ligneous collections during 1913 has been made by the purchase from Messrs. Veitch of about 250 rare Chinese trees and shrubs collected by Wilson and Purdom. The impending dispersal of the collections at the Coombe Wood nursery made it imperative that Kew should acquire as many as possible of these before this lamentable but inevitable event happened. Many of the plants purchased were of species found by Wilson during his first journeys on behalf of Messrs. Veitch, which covered ground not since traversed by any collector. They have consequently not been again introduced, and some, not easy to propagate, are very rare in gardens. Many of the trees and shrubs are still under number, only the genus to which they belong being known. Among the more important ones obtained from Messrs. Veitch are: *Cladrastis sinensis*, *Corylopsis sinensis*, *Actinidia Henryi*, *Eleutherococcus leucorrhizus*, *Diospyros armata*, *Meliosma Veitchiorum*, *M. Oldhamii*, *Pyrus Folgueri*, *Styrax Hemsleyanum*, *S. Veitchiorum*, and *Tsuga chinensis*. A tree of great interest is the true *Aesculus chinensis* of Bunge. Long known by name in European collections, this horse chestnut has not really been represented anywhere (except possibly by a single tree at Segrez, in France) until introduced by Purdom from North China. For many years the Japanese tree *A. turbinata* did duty for it on the continent, and latterly it has been confused with the tree found farther south, in Hupeh, by Wilson. The latter has recently been distinguished as *A. Wilsonii* by Rehder. Bunge's *A. chinensis* from North China was included in the purchases from Messrs. Veitch.

A very valuable consignment of trees and shrubs was received from the Arnold Arboretum in December. Besides Chinese species of Wilson's and Purdom's collecting, many interesting North American ones were included. Amongst the more important items were *Larix Potaninii*, *L. Mastersiana*, new American poplars, plums and cherries, oaks, hickories and Chinese willows.

As the result of an official visit made in June by the Assistant Curator to the nursery of Messrs. Leon Chenault & Son at Orleans, this firm kindly presented to Kew over seventy new and rare trees and shrubs noted at that time. Amongst them were species that have been introduced to cultivation by French missionaries in China from districts not traversed by English collectors. Mr. Maurice L. de Vilmorin has also sent contributions from his fine collections at Les Barres.

From the Royal Botanic Gardens, Glasnevin, were sent about 30 kinds of trees and shrubs noted by the Assistant Curator during an official visit to Ireland in February. Among them were two seedlings of *Daphne retusa*, one of the rarest and most beautiful of Daphnes. Mr. T. Smith's remarkable nursery at Newry was visited at the same time and purchases made.



The most important contribution of seeds to the Arboretum were 449 packets, gathered by Mr. G. Forrest in South China. Some seeds of interesting species in North-West America were presented by Mr. F. R. S. Balfour of Dawyck.

Acknowledgments are due to Canon Ellacombe, Miss Willmott, the Hon. Vicary Gibbs, and other amateurs for their willingness to contribute what they can towards making the national Arboretum as complete as possible.

The following trees and shrubs have flowered in the Arboretum Department for the first time:—

*Berberis brevipaniculata* and *B. subcaulialata* (China).

*Ceratostigma Willmottiana* (China).

*Cotoneaster turbinata* (China).

*Davidia involucrata* (China).

*Deutzia compacta* (China).

*Fatsia horrida* (North-West America).

*Jasminum Beesianum* (China).

*Meliosma cuneifolia* (China).

*Prunus microlepis* var. *Smithii* (Japan).

*Rhododendron nigro-punctatum* (China).

**Waterfowl.**—The number of eggs laid during the past year has been greater perhaps than ever before, but a large proportion has proved to be infertile. Of the birds hatched out, however, the majority were reared.

As usual, the greatest success was obtained with Carolina ducks, of which 27 were reared, ducks being considerably in excess of drakes. Other ducks reared were as follows—cinnamon teal, 5; blue-winged teal, 1; Bahama pintails, 3; common pochards, 3, as well as hybrid yellow-bills and tufted ducks.

Four birds were reared as the result of a cross between a yellow-bill drake and a Chiloe wigeon. The hybrids are handsome birds, with marked resemblance to the Chiloe wigeon, though lacking a good deal of the brightness of colour of the wigeon. Another hybrid—a cross between a maned gander and a yellow-bill duck—was produced as last year. In this case the hybrid is a distinct duck of a pale grey colour.

For the first time in the history of the Gardens the black-necked swans succeeded in rearing their offspring, and a handsome pair of young birds was the result. Two other events were of particular interest, namely, the rearing of a family of four by the bar-headed geese, which were sent to the Gardens from India in 1903, and have never before attempted to breed, and the rearing of a white-fronted goose. The pair of white-fronted geese were purchased in 1901, and this year, for the first time, two eggs were laid, both of which were fertile, but only one of the young birds was successfully reared.

The Canadian, China and white geese all reared families.

Of other birds, the storks failed to hatch out their eggs, having been disturbed when nesting, and the Demoiselle cranes were again unsuccessful with their solitary egg. Several peafowl were also reared.

Among losses during the year should be recorded the carrying off of a Magellan goose, when setting on her nest of eggs, by the badger, which has a large earth in Queen's Cottage grounds, and the similar fate of the Muscovy duck, which had a nest near that of the goose. A bar-headed goose has also been lost, apparently from the same cause.

During the breeding season many of the ducks wander to the further parts of the Gardens, and sometimes stray beyond the boundaries, and get to the river. The chestnut-breasted teal and a pair of wandering tree-ducks were the most serious losses this year.

Several interesting birds have been added to the Kew Collection by presentation or by exchange during the past year, and we are indebted to Mr. W. H. St. Quintin, of Scampston Hall, Rillington, York, for a pair of American wigeon, and we also received three chestnut-breasted teal from him, in exchange for Kew-reared birds, to replace those lost in the summer. One chestnut-breasted teal, a pair of wandering tree-ducks, three Magellan geese, and a Muscovy duck from the Zoological Society of London, a pair of herons from the Right Hon. James Round, of Birch Hall, near Colchester. A pair of Brent geese and a peacock were presented by H.M. Office of Works. One pair of white-eyed ducks were received in exchange from Mr. G. Legge, Patshull House, Wolverhampton. A pair of magpie geese were received in exchange from Commander Oliver Backhouse, H.M.S. *Excellent*, Portsmouth, and two mandarin ducks from Sir Richard Graham, Netherby.

A presentation of a pair of peacocks and a pair of brown China geese was made to H.M.S. *Excellent*, Portsmouth, and of a pair of brown China and Canadian geese to the Fitzgerald Park, Cork, and of Carolina ducks to H.M. Office of Works for the ornamental water in St. James's Park.

A consignment of young penguins was very kindly sent by Dr. Peringuey from Cape Town for the Royal Botanic Gardens, but owing to the difficulty experienced in keeping the birds previously received within bounds, they have been left in charge of the Zoological Society, Regent's Park, London.

**Official Visits.**—During the past year the vote for travelling expenses has been utilised as follows:—

The Curator.—In connection with a visit to the Quinquennial Exhibition of the Royal Society of Agriculture and Botany of Ghent and to horticultural establishments in Belgium.

The Assistant Curator.—To visit the arboretum of the Marquis of Headfort, in process of formation, and other gardens in the East of Ireland, and in a visit to Mr. Allard's arboretum at Angers, and other private and nursery gardens in France.

Mr. Irving.—In visiting the Royal Botanic Gardens, Edinburgh, and horticultural establishments in the neighbourhood.

Mr. Taylor.—In visits to gardens in the south and south-west of Ireland.

The Keeper of the Herbarium.—For the purpose of attend-

ing the 200th Anniversary of the Foundation of the Imperial Botanic Garden of Peter the Great, at St. Petersburg, as the representative of the Royal Botanic Gardens, Kew (see *K.B.* 1913, p. 243).

Mr. R. A. Rolfe, Assistant in the Herbarium.—To visit the Quinquennial Exhibition at Ghent and the Brussels Herbarium.

Mr. J. Hutchinson, Assistant for Africa.—For the purpose of examining types of African plants in the Herbaria at Paris, Brussels, Berlin, &c.

Mr. A. D. Cotton, Assistant in the Herbarium.—To study the cryptogamic vegetation of Blakeney Point, Norfolk.

The Keeper of the Museums.—For the purpose of attending the meeting of the Museums' Association at Hull.

Mr. J. H. Holland, Assistant in the Museums.—In a visit to Truro in connection with forestry exhibits at the Bath and West and Southern Counties Show.

Mr. W. Dallimore, Assistant in the Museums.—For taking part in the excursion of the Royal Scottish Arboricultural Society to Switzerland to study Swiss forestry methods. Also for a visit to Cornwall to inspect various timbers offered for the Forestry Museum by Mr. Reginald Rogers, Falmouth, and to study the bulb industry of the Scilly Islands (see *K.B.* 1913, p. 171).

**Museums.**—Many interesting products have been added to the collections during the past year, the more important of which have already been recorded in the *Bulletin*.

All available duplicates have been distributed to various institutions, including the following:—Hartley Laboratories, Liverpool University; Royal Agricultural College, Cirencester; Botanic Garden, Oxford; Municipal Museums, Hull, etc.

An exhibit was prepared for the Forestry Section of the Bath and West and Southern Counties Show held at Truro.

As in past years the Museum Staff has been fully occupied in determining various products submitted by Scientific Institutions, Commercial Firms, etc., and in furnishing general information on their properties, uses, references to literature, etc.

The assistance of an additional Museum Preparer has greatly facilitated the preparation of material for Museum IV., and much progress has been made in developing this Museum. Two additional wall cases have been added during the year, and it is much to be desired that the remaining cases needed to complete the furnishing of the Museum may be provided at no distant date.

The work of generally improving the permanent collections has gone on steadily. In Museum No. I. the repolishing of the cases has been completed. The relabelling of the contents of this Museum has been continued.

Individual members of the staff attended the Bath and West and Southern Counties Show held at Truro, the meeting of the Museums Association at Hull, and the annual excursion of the Royal Scottish Arboricultural Society to Switzerland.



**Presentations to Museums.**—The following miscellaneous specimens have been received in addition to those previously recorded in the *Bulletin*:—

The Resident Commissioner, Tulagi, British Solomon Islands.—Gum copal from *Agathis macrophylla* from the Island of Vanikoro.

Mr. R. Fox, Falmouth.—Section of trunk of *Sophora tetraptera*.

Lady Smyth, Ashton Court, Bristol.—Photographs of forest scenery on the Ashton Court Estate.

Mr. Campbell P. Ogilvie, Finsbury Circus, London.—Railway sleeper, wood for fencing and tanning extract of Quebracho Colorado (*Quebrachia Lorentzii*) from the Argentine.

United States Department of Agriculture, Washington, D.C.—Fruits of *Diospyros Lotus*, *Zizyphus sativa*, etc.

Director of Agriculture, Peradeniya, Ceylon.—Stems of *Hedychium coronarium*.

Superintendent, Royal Gunpowder and Small Arms Factory, Enfield Lock.—Sections of wood of *Salix fragilis*, *Alnus glutinosa*, and *Rhamnus Frangula*, together with samples of charcoal prepared from same.

Messrs. Ide & Christie, Mark Lane, London.—Paper made from bamboo, Tonkin.

Dr. F. D. Drewitt, Kensington.—Lobster pot from Cornwall made partially of the wood of Tamarisk.

Mr. H. St. George Gray, Taunton Castle, Somerset.—Sample of Alder wood from Roman site, Barrington, Somerset.

Messrs. Dalton and Young, Fenchurch Street, London.—Sample of Valonia (*Quercus Aegilops*) from Smyrna.

Mr. E. D. Merrill, Bureau of Science, Manila.—Fruit of *Strychnos Ignatii* from Samar.

Mr. E. A. Lee, Liphook, Hants.—Transverse section of wood of *Cedrus Libani*.

Mr. T. Carter, Manhead, near Exeter.—Well-marked section of wood of *Quercus Ilex*.

Mr. C. Wakely, East Anglia Institute of Agriculture.—Section of wood of *Koeleruteria paniculata*.

Mr. F. Evans, Southern Nigeria.—Fruits of *Cocos nucifera* collected in Panama.

Professor Dr. van Iterson, junr., Delft.—Fruits of *Pseudo-phoenix vinifera* from Haiti.

J. M. H.

#### Research in Jodrell Laboratory in 1913:—

[**Boodle, L. A.**]—The Root and Haustorium of *Buttonia natalensis*. (*Kew Bull.*, 1913, pp. 240-242, with two figs. in text.)

[**Massee, G.**]—Additions to the Wild Fauna and Flora of the Royal Botanic Gardens, Kew: XIV. (*Kew Bull.*, 1913, pp. 195-199, with one plate.)

**Massee, G.**—A new Grass Parasite (*Cladochytrium graminis*, Büsgen). (*Kew Bull.*, 1913, pp. 205-207, with seven figs. in text; and *Journ. Board Agric.*, vol. XX., pp. 701-703, with one plate.)

**Massee, G.**—A Disease of *Narcissus* Bulbs. (*Kew Bull.*, 1913, pp. 307-309, with one plate.)

**Massee, G.**—Nematodes or Eelworms. (*Kew Bull.*, 1913, pp. 343-351, with one plate and four figs. in text.)

[**Massee, G.**]—Clover Sickness. (*Journ. Board Agric.*, vol. XIX., pp. 928-930, with one plate.)

[**Massee, G.**]—*Rhizoctonia* Diseases. (*Journ. Board Agric.*, vol. XX., pp. 416-419, with one plate.)

[**Massee, G.**]—Apple Leaf-Spot. (*Journ. Board Agric.*, vol. XX., pp. 513-515, with one plate.)

[**Massee, G.**]—The Lattice-Fungus. (*The Field*, 1913, p. 911, with one fig. in text.)

**Massee, Miss Ivy.**—The Sterilisation of Seed. (*Kew Bull.*, 1913, pp. 183-187, with two plates; and *Journ. Board Agric.*, vol. XX., pp. 796-801, with two plates.)

Mr. L. A. Boodle carried out some cultural experiments with gorse-seedlings, and examined some anatomical features in *Buttonia* sp., and several other plants.

Prof. F. O. Bower made a comparative study of Ferns of Blechnoid affinity.

Mr. C. O. Farquharson investigated a Cacao and Rubber disease.

Miss Ivy Massee made experiments on the sterilisation of seed, and was engaged in researches on the life-history of a species of *Ustilago*, and on a Water-Lily disease.

Prof. R. B. Thomson made an examination of specimens of *Pinus* spp. showing abnormal growth after injury.

Mr. W. C. Worsdell studied some abnormal specimens of plants in connection with his morphological work on Vegetable Teratology.

**Pathology.**—A very large amount of material has been submitted to Kew for investigation during the past year. A grass disease caused by *Cladochytrium graminis*, Büsgen, which proves destructive to lawns, appears to be much on the increase in this country. The disease is introduced with the seed.

The sterility of apparently sound seed wheat has been proved to be due, in many instances, to the presence of mycelium in the pericarp of the grain. This mycelium commences active growth when the grain germinates and destroys the seedling.

A soft rot of narcissus bulbs has unfortunately become very prevalent. The leaves are attacked first, the mycelium passing

down into the bulb-scales. The fungus parasite causing this injury is *Fusarium bulbigenum*, Oke. and Mass.

A bacterial heart-rot of celery appears to be on the increase, and has, in one instance, been traced to the use of lime. Manure having an acid reaction, as superphosphate, should be used.

Work is in progress for the purpose of determining which, amongst the legion of fungi now credited with causing diseases, are in reality primary causes of disease, and not merely factors in aggravating a disease originally due to some other cause.

Diseased material has been received from the Federated Malay States, Nigeria, Gold Coast, West Indies, and a serious disease of bananas from Fiji is at present under observation.

**Additions to the Herbarium during 1913.**—During the year about 20,000 specimens were received as donations or exchanges, as well as the Wallichian and Horsfield Herbaria, while about 7300 were purchased, and 5200 received on loan. The principal collections are enumerated below:—

EUROPE.—*Presented*: Iceland, by Miss L. S. Gibbs; the British Herbarium of John Tatham, by Prof. Silvanus Thompson; Britain, by the Rev. H. J. Riddelsdell; Flora Hungarica Exsiccata, Cent. i., by the Hungarian National Museum; Kryptogamia Exsiccata, by the K. K. Naturhistorisches Hofmuseum, Vienna; Gibraltar, by Major A. H. Wolley-Dod, R.A.; Eastern Atlantic Algae, by Prof. C. Sauvageau.

*Purchased*: Dr. A. von Hayek, Centaureae Exsiccatae Criticae, fasc. 1; H. Sydow, Mycotheca Germanica, fasc. 24; W. Brinkman, Westfälische Pilze, Liefr. 1-4; Fiori & Béguinot, Flora Italica Exsiccata, Cent. xvii.-xviii., and Xylotomotheca Italica.

NORTH AFRICA AND ORIENT.—*Presented*: Isle of Ormuz, Persian Gulf (Paul B. Popenoe), by Mr. F. W. Popenoe; Kashaf Rud, Persia, by Mrs. P. M. Sykes.

*Purchased*: F. Vester & Co., Palestine; — Haradjian (per Dr. J. Briquet), Northern Syria; M. Gandoger, Moroccan Algae; R. Maire, North African Fungi.

NORTHERN ASIA.—*Presented*: Kamtschatka, by the Imperial Botanic Garden of Peter the Great, St. Petersburg; Siberia, Mongolia and Chinese Turkestan (F. N. Meyer), by U.S. Dept. of Agriculture.

CHINA AND JAPAN.—*Presented*: China and Tibet (G. Forrest), by the Royal Botanic Garden, Edinburgh; Yung Chun, China, by Mr. H. F. Rankin; Formosa, by Dr. B. Hayata through Mr. W. R. Price.

*Purchased*: Père E. J. Taquet, Corea.

INDIA.—*Presented*: The Wallichian Herbarium, by the Linnean Society; India, various localities, by the Royal Botanic Garden, Calcutta, Mr. J. S. Gamble, Mr. A. Meebold and Mr. J. Ramsay Drummond; Central Provinces, by Mr. H. H. Haines;



Madras, by Lady A. G. Bourne; Burma (W. Micholitz), by Messrs. Sander & Sons; Gunong Mengkuang Lebah and Gunong Kerbau, by Mr. H. C. Robinson; Kuala Lumpur (M. Hashim), by Mr. C. Hummel.

*Purchased*: Rev. A. Saulière, Madura District, Madras.

MALAYA.—*Presented*: Siam, by Dr. A. F. G. Kerr and Mrs. D. J. Collins; Siam (Prä, formerly Luang, Vanprük), by Mr. W. F. Lloyd; Indo-China and Borneo, by Mr. E. D. Merrill; Philippine Islands, by Mr. E. D. Merrill and Mr. Oakes Ames; British North Borneo, by Miss L. S. Gibbs; Java, the Horsfield Herbarium, by the Linnean Society; Java (Dr. S. Koorders and others), by Dr. J. C. Koningsberger.

POLYNESIA.—*Presented*: Hawaii, by Mr. E. D. Merrill.

TROPICAL AFRICA.—*Presented*: Sierra Leone, by Mr. C. E. Lane-Poole; Gold Coast, by Mr. T. F. Chipp; Northern Nigeria, by Mr. T. Thornton; Northern Nigeria, by Dr. J. M. Dalziel; Southern Nigeria, by Mr. N. W. Thomas; Somaliland, by Dr. R. E. Drake-Brockman; British East Africa, by Mr. E. Battiscombe; Uganda, by Mr. J. D. Snowden; Uganda (R. Fyffe), by Mr. W. R. Rutter; Congo Region, by Prof. E. De Wildeman; Rhodesia, by Mr. H. Godfrey Mundy; Rhodesia (Dominican Sisters), by Dr. S. Schönland; *Ficus*, by the Königlich Botanischer Garten, Dahlem, and Prof. E. De Wildeman; Percy Sladen Memorial Expedition (Prof. H. H. W. Pearson and others), by the Percy Sladen Memorial Trustees.

*Purchased*: G. Zenker, Cameroons; G. Scheffler, Uganda; Rev. F. A. Rogers, Rhodesia.

MASCARENE ISLANDS.—*Presented*: Madagascar (E. Perrier de la Bâthie), by Prof. H. Jumelle.

SOUTH AFRICA.—*Presented*: Great Namaqualand (Prof. H. H. W. Pearson and others), by the Percy Sladen Memorial Trustees; Giftberg (E. P. Phillips), by the South African Museum and the Percy Sladen Memorial Trustees; Orange Free State, Natal, etc. (Dr. Otto Kuntze), by the New York Botanical Gardens; Basutoland (M. and Mme. Dieterlen), by Prof. C. Flahault; Basutoland (E. P. Phillips and others), by the South African Museum.

*Purchased*: H. Rudatis, Natal.

NORTH AMERICA.—*Presented*: Arctic America (Fram Expedition), by Prof. J. N. F. Wille; specimens of cultivated *Phaseoli*, by the United States Department of Agriculture.

*Purchased*: F. S. Collins, Phycotheca Boreali-Americana, fasc. 38.

CENTRAL AMERICA.—*Presented*: Mexico (C. R. Barnes and W. J. G. Land), by Prof. C. F. Millspaugh; Mexico (Frères G. Arsène and Nicholas), by H.S.H. Prince Roland Bonaparte.

*Purchased*: J. Héribaude, Mexico; A. Tonduz, Costa Rica.

WEST INDIES.—*Presented*: Cuba, etc., by the New York Botanical Garden; Tobago, etc., by Mr. W. E. Broadway.

*Purchased*: Miguel Fuertes, San Domingo.

**SOUTH AMERICA.**—*Purchased*: J. Héribaud, Colombia; K. Fiebrig, Paraguay; E. H. Hassler, Paraguay and Brazil; Otto Buchtien, Herbarium Bolivianum, cent. ii, iii and iv.

**GENERAL.**—*Presented*: Abate G. Bresadola, Fungi.

*Purchased*: Dr. F. Petrak, Cirsiotheca, fasc. 1-12; H. Sydow, Fungi Exotici Exsiccati, fasc. 2, 3 and 4.

The most important accession during the year has been that of the Wallichian and Horsfield Herbaria, which were presented by the Linnean Society, and the cabinets to contain them obtained through the generosity of Sir Frank Crisp, Bart. An account of these collections has been published in the *Kew Bulletin*, 1913, pp. 255-263. Prof. Silvanus P. Thompson has presented the British Herbarium of his grandfather, Mr. John Tatham of Settle, Yorks. Other British plants have been presented by the Rev. H. J. Riddelsdell, collected by himself and others. Miss L. S. Gibbs has presented plants collected by her in Iceland and British North Borneo. Major A. H. Wolley-Dod has presented a set of the Gibraltar plants collected by him, which he has worked out at Kew during the year.

An extensive collection made in Northern Syria by Haradjian has been acquired through Dr. J. Briquet, and a set from Palestine has been purchased from Messrs. F. Vester and Co., of Jerusalem. Prof. C. Savageau has presented a collection of Eastern Atlantic specimens of *Cystoseira*, illustrating his comprehensive paper published in the *Bulletin de la Station biologique d'Arcachon*, vol. xiv (1912). Additional specimens collected in China and Tibet by Mr. G. Forrest have been presented by the Royal Botanic Garden, Edinburgh. Mr. Herbert C. Robinson has sent the collections made by him in the Malay Peninsula; that from Gunong Kerbau coming chiefly from an altitude of about 5500 ft. Dr. A. F. G. Kerr, who has been working out certain of his Siamese plants while on a visit to Kew, has continued to present specimens, and through his kind offices other specimens from Siam have been received from Mrs. D. J. Collins. Mr. Elmer D. Merrill has continued to send plants from the Philippine Islands, and has presented others from Indo-China, Borneo and Hawaii. A valuable set of Javan plants collected by Dr. S. Koorders and others has been presented by Dr. J. C. Koningsberger.

Interesting collections from the Abinsi and Mundu districts of Northern Nigeria have been received from Dr. J. M. Dalziel. Uganda plants from Entebbe have been received from Mr. R. Fyffe, and from Mubendi and Toro from Mr. J. D. Snowden. Over 1300 specimens have been received from the various expeditions made under the auspices of the Percy Sladen Memorial Trustees, including that to the Great Karasberg.

Prof. J. N. F. Wille presented a set of plants collected in Arctic America during the Fram Expedition, 1898-1902. An interesting collection from Kamtschatka was presented by the Imperial Botanic Garden of Peter the Great, St. Petersburg. Collections made in various West Indian islands by Dr. N. L.

Britton and others have been presented. A further instalment of K. Fiebrig's Paraguay plants from Alto-Parana has been purchased through Mr. P. Weber.

**Presentations to the Library during 1913.**—The Bentham Trustees have presented a copy of the scarce little work on agriculture by Pierre de Quiqueran, translated from Latin by F. Ninj de Claret, and published at Tournon in 1616. Its title is: *La nouvelle Agriculture, ou instruction generale pour ensementer toutes sortes d'Arbres fructiers, avec l'usage et proprietz d'iceux. . . . avec divers traictez des couleurs et naturel des Animaux.* The original Latin edition was published in Paris in 1551, after Quiqueran's death.

*The Trees of Great Britain and Ireland*, by H. J. Elwes and A. Henry, has been completed during the year with the issue of the seventh volume and an index to the whole work. The first volume appeared in 1906, and, excepting the prefatory matter and the postscript, the volumes have been paged continuously, terminating at page 2022. Most of the plates, of which there are 412, are reproductions by the Autotype Company of London of very fine photographs of trees remarkable in the majority of instances for their magnificence. Two complete copies of this costly work, which will for all time be a treasury of knowledge dealing with the trees indigenous or cultivated in the British Isles, have been presented by the Bentham Trustees. They have also presented the volumes published during the year of about thirty periodicals, which are forwarded to Kew in exchange for *Hooker's Icones Plantarum*.

The *Comptes Rendus* of the Academy of Sciences, Paris, the previous issues of which had been received from Sir J. D. Hooker, has been continued as a presentation to the library by Lady Hooker; and most of the weekly issues of *Science* for 1913 have been contributed by Miss Alice Eastwood of the California Academy of Sciences.

The heirs of the late Dr. Th. Durand have presented a copy of the *Conspectus Florae Africae*, by Dr. Durand and Prof. Hans Schinz. So far as published, this work consists of vol. i. pt. 2, and vol. v.

The publications received from the Botanical Museum of the University of Zurich, through Prof. Hans Schinz, include a copy of Dr. Thellung's voluminous dissertation *La flore adventice de Montpellier, Beiträge zur Kenntnis der Schweizerflora*, xiii. and xiv., *Beiträge zur Kenntnis der Afrikanischen Flora*, xxv., and the paper by Dr. Schellenberg, Prof. Schinz and Dr. Thellung on the flora of Colombia and the West Indies, extracted from Fuhrmann & Mayor's *Voyage d'exploration scientifique en Colombie*.

Prof. R. Chodat has presented a number of papers prepared by various workers in the Institute of Botany of the University of Geneva, and a copy of his *Monographies d'Algues en culture pure*, which forms part of the *Matériaux pour la flore cryptogamique suisse*.

A seventh volume of Mr. W. Foster's work, *The English Factories in India*, dealing with the period 1642-45; *Colloquies on the Simples and Drugs of India*, by Garcia da Orta, translated by Sir Clements Markham from Count Ficalho's edition published in Lisbon in 1895; and *Notes on the Agricultural Conditions and Problems of the United Provinces*, by W. H. Moreland, have been received from the Secretary of State for India. Garcia da Orta's work was originally published in Portuguese at Goa in 1563, and this edition is now extremely rare. It is the third book issued from the Press in India.

The third volume of *Die palaeobotanische Literatur*, edited by W. J. Jongmans, and *Mededeelingen van 's Rijks Herbarium, Leiden*, Nos. 8-14, have been received from the Director of the Herbarium named.

Seven copies of Supplement IV. to the Index Kewensis, which was published on November 13, have been presented by the Delegates of the Clarendon Press, Oxford. This Supplement includes the names published during the years 1906 to 1910, together with others of earlier dates which were omitted from the original Index and the previous Supplements.

An addition of much usefulness is the fourth volume of the *Catalogue of the Books . . . in the British Museum (Natural History)*, which now extends as far as Snyder. This, with two copies of the *Catalogue of the Plants collected by Mr. and Mrs. P. A. Talbot in the Oban District, South Nigeria*, prepared by A. B. Rendle, E. G. Baker, S. Moore and others, has been contributed to the library by the Trustees of the British Museum.

From Sir Frank Crisp, Bart., has been received a copy of *Les Plantes des montagnes et des rochers: leur acclimatation et leur culture dans les jardins*, by H. Correvon; from Mr. J. C. Williams, G. Forrest's *Field Notes*; from Col. D. Mills, H. van Heurck's *Prodrome de la Flore des Algues marines des Isles Anglo-Normandes*, etc.; from Mr. Clement Reid, *Illustrations of Fossil Plants*, prepared under the supervision of J. Lindley and W. Hutton, and published by the North of England Institute of Mining and Mechanical Engineers in 1877, and a copy of his little book on *Submerged Forests*.

Messrs. Scott, Greenwood and Co. have sent *Insecticides, fungicides and weedkillers*, by E. Bourcart, and the third edition of *A manual of Agricultural Chemistry*, by H. Ingle; Messrs. Longmans, Green & Co. and the authors have sent copies of *Planting in Uganda*, by E. Brown and H. H. Hunter; Messrs. Houghton Mifflin Company, volume ii, part 4 of *Trees and Shrubs*, edited by Prof. C. S. Sargent, who has presented the third part of *Plantae Wilsonianae*, of which he is also the editor; and the publishers, Messrs. F. Tempsky and G. Freytag, *Unsere Freiland-Nadelhölzer*, by Ernst Graf Silva Tarouca and others.

Sir William T. Thiselton-Dyer, K.C.M.G., has presented his notebook on Carnivorous Plants, including his studies of the glands of *Nepenthes*, which was prepared for Sir J. D. Hooker's address to the British Association at Belfast in 1874, and a volume of 28 pamphlets on Carnivorous Plants by various authors.



Among the other more important contributions to the library are: *Nova Guinea* (Résultats de l'Expédition Scientifique Néerlandaise à la Nouvelle-Guinée en 1912 et 1913 sous les auspices de A. Franssen-Herderschee), vol. xii. livraison 1, from the Maatschappij ter Bevordering van het Natuurkundig Onderzoek der Nederlandsche Koloniën; *Les aspects de la végétation en Belgique*, by C. Bommer and J. Massart (*Les districts flandrien et campinien*, by J. Massart), from the Director of the State Botanic Garden, Brussels; *A Flora de Portugal* (Plantas vasculares), by A. X. P. Coutinho, from the Director, Royal Botanic Gardens, Kew; *Webbia*, vol. iv. part 1, from the editor, Prof. U. Martelli; several works on Algae, including *Liste des Algues du Siboga*, by Mrs. A. Weber van Bosse; *Agave in the West Indies*, by W. Trelease, from Mr. N. E. Brown; *Icones Plantarum Formosanarum*, by B. Hayata, fasc. 2, from the Director of the Bureau of Productive Industries, Formosa; the continuation of the *North American Flora*, from Dr. N. L. Britton; a complete set of the *Bulletin de la Société Dendrologique de France* (8 volumes), from Mr. W. J. Bean; a large collection of reports and pamphlets, mainly on forestry, from Mr. J. S. Gamble; *National Hardy Plant Society's Year-Book*, 1912 and 1913, from the Editor, Mr. A. J. Macself; *Transactions of the Society of Arts*, vols. xlviii. and l. pt. 2, and *Journal*, vols. ii. and iii., from the Secretary; *Arbejder fra den Botaniske Have i København*, including *Danish Fungi as represented in the Herbarium of E. Rostrup*, revised by J. Lind, from the Botanical Library of the University of Copenhagen; and a manuscript catalogue of the British Herbarium of John Tatham of Settle, from his grandson, Prof. Silvanus P. Thompson, who has, moreover, presented the Herbarium itself to the establishment.

The numerous publications of the Department of Agriculture in the Dutch East Indies and of the Agricultural Research Institute, Pusa, issued during the year, have been received from the respective directors of those establishments, and a selection of the publications of the United States Department of Agriculture, from the Secretary.

Other contributions to the library, made in most instances by their authors, will appear in the annual supplement to the catalogue which forms Appendix II. to the *Kew Bulletin*.

---

**Hibiscus Arnottianus.**—During the stay of H.M.S. *Blossom* at Oahu, Sandwich Islands, in May, 1826, a fruiting specimen of a *Hibiscus* was gathered, which Hooker and Arnott identified doubtfully with *H. Boryanus*, DC. (Bot. Beechey's Voyage, p. 79). Their remarks on it are as follows:—

“From the imperfect state of the specimen before us, we cannot affirm it positively to be the plant of De Candolle. The leaves are ovate, slightly coriaceous, three-nerved, perfectly smooth, and quite entire. The peduncles are short, scarcely an inch long, and very stout. The calyx five-toothed and split up one side by the swelling of the fruit, as in De Candolle's section

*Manihot*. The carpels are polyspermous and the seeds covered with fulvous hairs. Perhaps, then, this is a new species, and more closely allied to *H. rhombifolius*, Cav.; but we possess a plant in flower from Owhyhee, collected by Mr. Macrae in Byron's Bay, which seems to be the same as ours: this certainly belongs to the section *Cremontia* by the nature of its corolla, and has toothed leaves, as in *H. Boryanus*: the flowers are, however, red, not white, and the leaves are three-nerved, as in the specimen from Oahu."

*H. Boryanus*, DC., is a native of Réunion (Bourbon), and differs from both the Sandwich Islands plants mentioned by Hooker and Arnott in its involucre bracts, which are longer than the calyx (DC. Prodr., vol. i, p. 446). The Beechey Voyage plant, which has white flowers, has since received the name *H. Waimeae* var. *Hookeri*, Hochr. (Ann. Conserv. & Jard. Bot. Genève, vol. iv, p. 132); and the red-flowered plant collected by Macrae at Byron's Bay, Hawaii, is identical with *H. kokio*, Hillebrand.

Asa Gray pointed out in 1854 (Bot. U.S. Expl. Exped., vol. i, p. 177) that the two Sandwich Islands plants referred to *H. Boryanus* by Hooker and Arnott were distinct from that species, but he failed to recognise that they also differed from each other, and accordingly described them as a single new species, to which he gave the name *H. Arnottianus*. The characters of the two species are so intermingled in Gray's description that it agrees with neither: the long staminal column, for example, being a characteristic of *H. Waimeae* var. *Hookeri*, and the red flowers, of *H. kokio*. If the name *H. Arnottianus* is not to be relegated to synonymy, as being a source of confusion, it seems that it should be applied to *H. kokio*, since this was the species of which Gray had material before him when he first proposed the name. In 1837 Gray sent a specimen of this species, collected on Oahu by Diell, to Sir William Hooker, under the name *Hibiscus Arnottii*, Gray (he subsequently altered the name to *Arnottianus*).

Hillebrand, however, who was the first to distinguish the two Sandwich Islands species, applied the name *H. Arnottianus* to the one collected during Beechey's Voyage, i.e., to *H. Waimeae*, var. *Hookeri*, Hochr., and described the red-flowered species as *H. kokio* (Fl. Hawaiian Isl., p. 48).

A. A. Heller followed Hillebrand in calling the Beechey Voyage plant *H. Arnottianus*, but considered that there was a second white-flowered species in the Sandwich Islands, which differed in having suborbicular, crenate leaves. This he proposed as a new species, *H. Waimeae* (Minnesota Bot. Studies, vol. i, p. 851).

Hochreutiner, on the other hand, applied the name *H. Arnottianus* to the plant collected by Diell, i.e., to *H. kokio*. He considered that there was only one white-flowered species in the Sandwich Islands, and called it *H. Waimeae*, distinguishing a var. *Hookeri*, with entire leaves, founded on the Beechey plant, and a var. *Helleri*, with crenate leaves, based on Heller's own specimen (Ann. Conserv. & Jard. Bot. Genève, vol. iv, p. 132).

So much confusion has arisen in the past in connection with the name *H. Arnottianus* that it is perhaps desirable to abandon the use of it altogether. The three Sandwich Islands plants whose history has been given may be distinguished as follows:—

- Flowers white; involucre bracts reflexed;  
 staminal column much exserted; style-  
 arms sub-erect ... .. *H. Waimeae*.  
 Leaves broadly ovate, entire; calyx under  
 2 cm. long ... .. var. *Hookeri*.  
 Leaves usually elliptic or suborbicular,  
 crenate; calyx 2.5–3 cm. long ... .. var. *Helleri*  
 (=typical *Waimeae*).  
 Flowers red; involucre bracts sub-erect;  
 staminal column hardly as long as the  
 petals (when these are extended); style-  
 arms spreading ... .. *H. kokio*.

**H. Waimeae**, A. A. Heller, in Minnesota Bot. Studies, vol. i, p. 851; Sprague in Bot. Mag. t. 8547. *H. Waimeae*, var. *Helleri*, Hochreutiner in Ann. Conserv. & Jard. Bot. Genève, vol. iv, p. 132. *H. Arnottianus*, H. Mann in Proc. Amer. Acad., vol. vii, p. 157; Hillebr. Fl. Hawaiian Isl., p. 48, partly. *H. Arnottianus*, forma, Sinclair, Indig. Fl. Hawaiian Isl., t. 8.

HAWAIIAN ISLANDS. Kauai: above Waimea, 900 m., Heller 2785. Oahu, Mann & Brigham 530. Hawaii, Mrs. Sinclair.

**H. Waimeae**, var **Hookeri**, Hochreutiner in Ann. Conserv. & Jard. Bot. Genève, vol. iv, p. 132. *H. Boryanus*, Hook & Arn. Bot. Beechey's Voy., p. 79, excluding Macrae's specimen, not of DC. *H. Arnottianus*, A. Gray, Bot. U.S. Expl. Exped., vol. i, p. 176, partly; Wawra in Flora, 1873, p. 173; Hillebr. Fl. Hawaiian Isl., p. 48, partly.

HAWAIIAN ISLANDS. Oahu, Lay & Collie; Hillebrand 374.

**H. kokio**, Hillebr. ex Wawra in Flora, 1873, p. 174; Hillebr. Fl. Hawaiian Isl., p. 48. *H. Boryanus*, Hook & Arn. Bot. Beechey's Voy., p. 79, as to Macrae's specimen, not of DC. *H. Arnottianus*, A. Gray, Bot. U.S. Expl. Exped., vol. i, p. 176, partly; Hochr. in Ann. Conserv. & Jard. Bot. Genève, vol. iv, p. 133, vars. *kokio* and *genuinus*. *H. Arnottianus*, forma, Sinclair, Indig. Fl. Hawaiian Isl. t. 9. *H. Remyi*, Hillebr. ex Hochr., l.c.

HAWAIIAN ISLANDS. Oahu, Diell 57. Hawaii, Macrae; Mrs. Sinclair. Also in Kauai and Molokai, according to Hillebrand.

*H. kahili*, C. N. Forbes in Occas. Papers Bernice Pauahi Bishop Mus. vol. v, no. 1, p. 4, is closely allied to *H. kokio*, from which it differs in the shape of the leaves and the indumentum of the calyx (described as tomentose in the Latin description, pubescent in the English). According to Mr. Forbes, there appear to be at least two other undescribed varieties or species related to *H. kahili*.

T. A. S.



**Botanical Magazine for January.**—The plants figured are *Erythrina pulcherrima*, Tod. (t. 8532); *Galtonia princeps*, Decne (t. 8533); *Carpinus japonica*, Blume (t. 8534); *Primula Purdomii*, Veitch (t. 8535), and *Lonicera deflexicalyx*, Batalin (t. 8536).

The beautiful *Erythrina*, like other similar species, was introduced into Italian gardens and thence found its way to Northern Europe. Its habitat is doubtful, but it is probably Argentina. *E. Crista galli*, Linn. from Brazil (see t. 2161) is the nearest ally of *E. pulcherrima* but the leaflets afford an easy character by which the two species may be distinguished. The plant figured flowered in the Palm House at Kew.

*Galtonia princeps* like its ally *G. candicans* is an interesting plant for out-door culture and is regularly grown at Kew. Its home is the Eastern region of South Africa on the Bazeia Mountain, and near Pietermaritzburg, at altitudes of nearly 3000 ft. The specimen figured flowered in the Cambridge Botanic Garden, and was collected by Canon G. E. Mason and Miss M. H. Mason in Tembuland. It differs from *G. candicans* in having the perianth segments shorter than the tube and the stamens attached near to the base of the tube.

The Hornbeam is a handsome species belonging to a well-marked section of the genus separated by some under the name *Distegocarpus*. This section is distinguished from *Eu-carpinus* by the more numerous parallel nerves of the closely imbricated fruiting bracts and the existence of a lobe or infolded base to each bract which completely covers the nutlet. *Carpinus cordata*, Blume, distinguished by its larger leaves and basal bract-lobe is the only other species in the section *Distegocarpus*. *C. japonica* was probably first introduced to Great Britain by Mr. C. Maries in 1879, but most, if not all, of the plants now in cultivation came in 1895 from the Arnold Arboretum, or from Tokyo. The figure was prepared from a tree sent by Prof. Sargent in 1895 which is now 16 ft. high.

*Primula Purdomii* is an interesting species, the seed of which was collected at 10–11,000 ft. at Tao-chow in western Kansu by Mr. W. Purdom, travelling on behalf of Messrs. J. Veitch & Sons, and the plant figured was raised by them from the seed sent home. It is allied to *P. nivalis* but differs in having the lobes of the corolla more rounded and entire and in the larger stigma and probably *P. Purdomii* should only be regarded as the geographical representative in Kansu of its Siberian and N. American congener *P. nivalis*.

Another Chinese plant is represented in the final plate in *Lonicera deflexicalyx* a species belonging to the subsection *Ochranthae*, Zabel (as amended by Rehder), and allied to *L. ovalis*, Batalin, and *L. tricosantha*, Bur. & Franch., also found in Yunnan, Szechuan and Eastern Tibet. Our species is easily distinguished by its narrower leaves and by the shorter ovarian bracts. The plant which yielded material for the figure was purchased for Kew from Mr. Späth of Berlin in 1908 and now forms a considerable bush. The flowers are a rich yellow and are borne in profusion, and as the plant usually escapes being damaged by frost it makes a valuable garden shrub.







RIBES WOLLENSSE.